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CASINO GAMING AND STATE LOTTERIES:

A FISCAL IMPACT ANALYSIS

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CENTER FOR POLICY ANALYSIS
UNIVERSITY OF MASSACHUSETTS DARTMOUTH

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UNIVERSITY OF MASSACHUSETTS DARTMOUTH
CENTER FOR POLICY ANALYSIS

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Economic Research Series No. 20

CASINO GAMING AND STATE LOTTERIES: A FISCAL IMPACT ANALYSIS

EXECUTIVE SUMMARY

The University of Massachusetts Dartmouth Center for Policy Analysis is conducting a comprehensive analysis of gaming in New England. The study is being completed and released in four phases: a patron origin analysis of Foxwoods Resort and Mohegan Sun Casinos, a patron origin analysis of the three New Hampshire race tracks on the Massachusetts border, an analysis of the impact of casino gaming on state lotteries and state revenue collection, and an economic impact analysis of proposals to construct casino resort facilities in Salisbury Beach, Hampden County, and Bristol County, Massachusetts.

This third phase of the analysis reviews the potential effect of casino gambling on State lottery performance and state revenue collections under the provisions of Senate No. 352. Senate No. 352 would authorize three casinos in Salisbury Beach, Hampden County, and Bristol County, Massachusetts. The analysis includes a revenue estimate based on previous studies of the impact of installing slot machines at Massachusetts' four race tracks.

Senate No. 352 would levy a special 6% tax on gaming revenues that is earmarked for Chapter 29 Direct Local Aid. The bill would also levies a special 1.5% tax on each facility's gaming revenues that is earmarked for the three host communities. An additional 1.5% tax on gaming revenues is earmarked for distribution to communities immediately contiguous to the host community. Finally, Senate No. 352 includes a 1.5% tax on gaming revenues to improve purses at the state's four race tracks, a 0.35% tax on gaming revenues to support law enforcement, and a 0.15% tax on gaming revenues to prevent and treat gambling problems.

The current phase of the center's comprehensive analysis evaluates the potential impact of casino gaming on state lottery revenues with statistical techniques including pre-test/post-test intervention analysis, regression analysis, a correlation matrix, and comparisons to other states. The study also estimates the total annual revenues that would be generated by casino gaming, based on conservative estimates of the potential market for casino resort facilities in Massachusetts.

The study's major findings are as follows:

- **The authorization of three casinos, located at Salisbury Beach, Hampden County, and Bristol County will generate approximately $123 million annually in state aid to municipalities under the provisions of Senate No. 352.**

  The provisions of Senate No. 352 will generate approximately $82 million in Chapter 29 Direct Local Aid; $20.5 million in direct revenues to the three host communities; and $20.5 million for municipalities contiguous to the three host communities.
- **The authorization of three casinos located at Salisbury Beach, Hampden County, and Bristol County will generate approximately $27.4 million annually for other purposes,**

including development of the greyhound and thoroughbred industries, law enforcement, and the prevention and treatment of gambling addiction:

The provisions of Senate No. 352 will generate approximately $20.5 million to improve the state's competitiveness in greyhound and thoroughbred racing; $4.8 million for law enforcement, and $2.0 million for the prevention and treatment of gambling addiction.

- **The authorization of up to 200 slot machines at Massachusetts' four race tracks could generate as much as $40.1 million annually to the state.**

  The estimate of revenues to the state is based on a win-per-slot of $280 per day, which is similar to the estimate that would accrue to New Hampshire race track slot machines. This is a conservative estimate well below the average win per slot per day enjoyed by Delware's three race tracks (January 1999, average win-per-slot = $369) and Prairie Meadows in suburban Des Moines, Iowa (January 1999, average win-per-slot = $296).

- **An important finding of the study, based on comparative revenue data, is that total gaming revenues returned to the state have increased after the introduction of casino gaming. There is no national pattern to lottery revenue performance after the introduction of casino gaming. Some states have substantial increases in lottery revenues after the introduction of casino gaming, some report a slow down in the rate of lottery revenue growth, while a few states report a decline lottery revenues. However, total gaming revenue has increased in every state after the introduction casino gaming, regardless of the state lottery's performance:**

  In Colorado, total gaming revenues to the state increased from **$58.9 million in FY 1991** (lottery = $58.9 million), the year before casinos were introduced to that state, to **$159.3 million in FY 1998** (lottery $97.6 million; casinos = $61.7 million).

  In Connecticut, total gaming revenues increased from **$221.3 million in FY 1992** (lottery = $221.3 million), the year before Foxwoods opened in that state, to **$520.4 million in FY 1998** (lottery = $264.3 million; casinos = $256.1 million) .

  Even in Louisiana, where lottery revenues to the state declined from **$115 million in FY 1992** (lottery = $115), the year before casino gaming was introduced, to $108 million in FY 1998, total gaming revenues to the state have increased to **$506.7 million in FY 1998** (lottery = $108 million; video poker = $163.4 million; casinos = $235.3 million).

  Similar patterns of total revenue growth were found in Illinois, Iowa, and Missouri, which have riverboat casinos, as well as New Jersey and South Dakota, which have land-based casinos.

In 1997, the Massachusetts State Legislature failed to act on legislation that would have authorized land-based casino gaming in Bristol County and Hampden County (H.B. 5518, 1997) and permit the installation of 700 electronic gaming devices (slot machines) at each of the Commonwealth's four commercial race tracks (H.B. 5520, 1997). The Joint Committee on Government Regulations oversees and considers legislation concerning the state's lottery, pari-

mutuel wagering, charitable gaming and bingo, and other forms of proposed gaming activity. While the Committee on Government Regulations did not issue a report on the proposed legislation, Representative Daniel Bosley (D-North Adams), Co-Chairman of the Joint Committee on Government Regulations submitted his personal opinion to Thomas Finneran (D-Mattapan), Speaker of the House, as a "*Report on Gaming Proposals, 1997.*" The Co-Chair's *Report on Gaming Proposals, 1997* recommended against any expansion of gaming in the Commonwealth. Among the reasons offered to support this recommendation was the claim that:

> "casino gaming will adversely impact our [the Commonwealth's] state lottery and, consequently, the revenue stream of dollars flowing to our cities and towns in the form of Local Aid....we need to weigh the losses to the state lottery with the revenue gains, if any, that we could make from the proposed casinos" (*Report on Gaming Proposals*, i, 11).

- **A number of states have enjoyed lottery sales increases since the introduction of casinos:**

  The Connecticut State Lottery has enjoyed annual average sales growth of 7.0% since the introduction of casino gaming in 1992. This sales growth translates into average additional sales of $43.6 million annually.

  A similar growth pattern was found in Colorado, where limited stakes gambling was introduced in 1991. Since that time, the Colorado State Lottery has recorded annual average sales growth of 10.9% or average additional sales of $26.9 million annually.

  Other states have exhibited lottery sales growth after the introduction of casinos, including Missouri and Illinois.

  Atlantic City casinos actively promote and advertise the state lottery and lottery sales have continued to increase in that state.

- **Since the introduction of casino gambling in Connecticut, the Connecticut State Lottery's contribution to state revenue has increased:**

  In fiscal year 1998, the Connecticut State Lottery contributed over $264 million in revenues to the State's General Fund, an average increase of over $7 million annually since the introduction of casino gaming.

  The Connecticut Division of Special Revenue commissioned a comprehensive study of the impact of casino gaming in Connecticut in 1996. The study, conducted by the WEFA Group, applies multiple regression modeling to ten years (FY 1987 to FY 1997) of Connecticut lottery data and concludes that "no impact from Foxwoods was found for Lottery sales in total or for sales of any individual Lottery game" in Connecticut.

- **Massachusetts State Lottery sales have continued a pattern of steady growth, since the introduction of casino gaming in Connecticut, despite the fact that Massachusetts**

residents patronize Connecticut casinos in larger numbers than the residents of any other state.

Intervention analysis found that the introduction of casino gambling in Connecticut did not affect Massachusetts State Lottery Sales. In fact, since Foxwoods opened in 1992, the Massachusetts State Lottery has recorded a pattern of steady sales growth. From Fiscal Year 1993 to Fiscal Year 1998, the MSL has reported average annual sales growth of 11.2%, which translates into average additional annual sales of $249 million. In the period prior to Foxwoods' opening (FY 1986 to FY 1992), average annual sales growth was 7.8%, which translates into average additional sales of $104 million annually.

- **The primary factors driving Massachusetts State Lottery growth in the 1990s have been the introduction of higher priced Instant game tickets and the addition of Keno to the product line:**

  A series of regression analyses of Massachusetts State Lottery sales finds that since the introduction of higher priced Instant games in January 1992, the best predictors of MSL sales performance are the Instant and Keno games, rather than exogenous factors such as casino gaming. The sales of these lottery products are highly correlated with total sales.

  These findings for the Massachusetts State Lottery are consistent with the WEFA Group's Connecticut study, which found that the primary substitution effect among gambling products is not between casinos and lotteries, but among lottery games.

  Given the similarities in product development, specifically the introduction of higher priced Instant games, and existing levels of casino visitation by Massachusetts residents, it is reasonable to conclude that a similar pattern of sales and revenue growth would occur in Massachusetts.

- **Instant ticket sales, the flagship game of the Massachusetts State Lottery, have been stable in the majority of states after the introduction of casinos:**

  The Massachusetts State Lottery relies heavily on Instant game sales, which account for 65% of all MSL sales. In Massachusetts, Instant game sales have enjoyed continuous growth since the introduction of casino gaming at Foxwoods and Mohegan Sun, despite the fact that Massachusetts residents patronize those casinos in larger numbers than the residents of any other state, including Connecticut.

- **The analysis finds that there is little substitution of spending between casinos and lotteries. There is limited overlap in the markets for these two forms of gambling activity. However, there is a substitution effect among lottery products:**

  A correlation matrix reveals that any slowdown in the rate of growth in Massachusetts state lottery sales is attributable to the substitution effect among lottery products and not to the introduction of casino gambling in Connecticut. A post-intervention correlation matrix finds that declining sales of Megabucks, MassCash, and Pull tabs are the result of

a substitution effect among lottery games, which distorts the statistical rate of lottery growth in Massachusetts.

Even under "a worst case scenario," proposed in a study financed by the Massachusetts State Lottery Commission, it was estimated that the introduction of casino gaming to Massachusetts would result only in a slowdown in the *rate of growth* in lottery sales.

The first phase of the analysis concluded that Foxwoods Resort Casino had total estimated revenues of $1.1 billion in 1998, which contributed $165 million dollars to Connecticut's General Fund. The Mohegan Sun Casino had total estimated gaming revenues of $560 million in 1998, which contributed $91 million dollars to the State of Connecticut's General Fund. The study estimates that in 1998 Massachusetts' residents spend approximately $468 million at Foxwoods Resort and approximately $126 million at the Mohegan Sun. This means that spending at Connecticut casinos by Massachusetts' residents has increased by nearly 42%, from $330 million in 1995, when the center conducted a previous patron origin analysis. Mohegan Sun recently announced a $950 million expansion that includes 100,000 square feet of additional gaming space, a 1,500 to 2,200 room luxury hotel, and a convention center with a 10,000 seat entertainment facility.

The second phase of the analysis concluded that Massachusetts' residents spend approximately $106 million per year at the three race tracks on New Hampshire's southern border with Massachusetts. The New Hampshire State Legislature is currently considering the installation of 3,750 video gaming devices at New Hampshire race tracks. The study estimates that if 1,000 video gaming devices were installed at southern New Hampshire's three racing facilities, Massachusetts residents could spend over $153 million annually on New Hamspshire's slot machines in addition to the $106 million current being spent at the tracks' parimutuel windows.

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1.00 PURPOSE OF THE STUDY

The University of Massachusetts-Dartmouth Center for Policy Analysis conducted an analysis of the effect the introduction of casino gambling has on state lottery performance and public finance. The study utilized data from a broad cross-section of lottery operating states that have legalized commercial casino activity. The study also assesses the impact changes in the structural characteristics of lottery products has on Massachusetts State Lottery performance. The study employs correlation matrices, regression analysis and ARIMA models to forecast the future sales performance of the Massachusetts State Lottery.

1.10 STATE LOTTERIES: HISTORY AND BACKGROUND

Since their reintroduction in 1964, State lotteries have assumed a prominent role within public finance. From their humble beginning in New Hampshire, lotteries continue to provide a stream of needed revenue to state government coffers. Several structural factors have contributed to a number of states jumping on the lottery bandwagon. Increasing citizen resistance to new forms of taxation in the late 1970s, the devolution of government known as New Federalism in the early 1980s, along with successful lottery operations in contiguous states, serve as the fiscal impetus underlying the plethora (20) of states which have began lottery operations since 1985. Thirty-eight states currently operate lotteries. During 1997 these government enterprises accounted for lottery sales of over 46 billion dollars. This record of fiscal success aided states in generating 16.5 billion dollars in government revenue from lottery sales during fiscal year 1997 (Christiansen 1998).

Lotteries have, and will continue to be, an integral facet of state public finance for the foreseeable future. In addition to their centrality to state budgetary practice, state lotteries have assumed a central place in the American cultural landscape (Dense 1997). Because they raise issues related to the very nature of government, state lotteries deserve to be taken seriously (Clotfelder and Cook 1989). Despite (or because of) this fiscal success, the relative autonomy of State lotteries over the American gambling landscape has recently come under attack. New forms of gambling activity, ranging the gamut from commercial (Non-Indian) casinos, Internet gambling, and Native-American casinos have rapidly proliferated during the 1990s. State Lottery supporters argue the addition of new forms of gambling, especially casino gaming, has a deleterious effect on lottery success. However, there has been a relative lack of research addressing the relationship between state lottery performance and the introduction of commercial casinos. This study will assess the effect the introduction of casino activity has on state lottery performance.

The Commonwealth of Massachusetts is considered by many to operate one of the most successful state lotteries in the United States. A recent study argued the Massachusetts State Lottery (MSL) wears the crown as the "effectiveness king of traditional lotteries". McQueen determined the Massachusetts State Lottery was ranked first among 38 states in terms of sales as a percent of state personal income (1.658%), and government revenue generated as a percent of state personal income (.375%). From an efficiency perspective, the MSL ranked first with regard to cents spent to generate one sales dollar (8.0) (McQueen 1998). This record of administrative efficiency and

effectiveness is a major contributing factor to the overall fiscal success of the MSL. However, a detailed examination of the sales performance of the Massachusetts State Lottery over the last decade reveals several insights which not only shed light on ways to improve MSL performance, but illuminate the fact lotteries and casinos can flourish within the same jurisdiction.

The Massachusetts State Lottery ranks first among 38 states with per capita sales of nearly $500 dollars. During fiscal 1998, MSL sales were over 3.3 billion dollars (MSL 1998a). This record of fiscal success is responsible for generating $602 million in Direct Local Aid to cities and towns throughout Massachusetts, or about $99 in local aid per capita (MSL 1998b). The Massachusetts State Lottery provides a significant source of revenue for residents of the Bay State. Given its centrality to public finance, any challenge to the fiscal autonomy of the Massachusetts State Lottery has encountered stiff resistance from state policymakers (Bosley 1997).

The last decade has seen the preeminence of State lotteries challenged throughout the United States. From a Massachusetts perspective, foremost of the legal developments having the potential to change the shape and scope of the New England gaming market was Congress' passage of the Indian Gaming Regulatory Act (IGRA) in 1988.[1] During the 1990s a total of 24 states have negotiated gaming compacts with 157 tribes throughout the country (Department of Interior 1998). One of the preeminent success stories within the recent proliferation of Native American gaming is Foxwoods Resort Casino in nearby Ledyard, Connecticut. Foxwoods contributed $165 million dollars to the State of Connecticut General Fund in fiscal year 1997. Together with the nearby Mohegan Sun, these two Indian casinos contribute over $256 million dollars annually to state revenue (Department of Special Revenue 1998). A large portion of this fiscal largesse comes at the expense of Massachusetts. A recent Center for Policy Analysis study estimated Massachusetts residents spent $468 million at Foxwoods and $126 million at the Mohegan Sun annually at these two gaming complexes (Center for Policy Analysis 1999). While state officials have questioned the methodology underlying this study, all parties agree a significant amount of the customer base at the Native American casinos in Connecticut is from Massachusetts.

1.20 LOTTERY PRODUCT DEFINITIONS

In an attempt to meet the omnipotent "revenue imperative" (Abt, Smith, and Christiansen 1985) underlying their operation, State lotteries provide a variety of products to consumers. There are three primary categories of traditional lottery games. Instant games are a longtime staple of the lottery product line. The ease of administering this scratch-off ticket based game led to them being the first game utilized by many states after lottery adoption. Daily Numbers games were formulated to attempt to tap the illegal numbers market that is a long time staple of the American urban landscape. On-line games like Mass Millions, Megabucks, the multi-state Big Game involve weekly or bi-weekly drawings. These lotto style games often accrue multi-million dollar jackpots when no player has his or her numbers drawn.

[1] 25 U.S.C. 2701.

In an attempt to maximize government revenue, and partially as a response to the proliferation of casino gaming throughout the United States, state lotteries have incorporated several casino-type games into their product portfolio. Keno style games require players to pick from one to ten numbers from a series of eighty numbers, with payoffs based on a fixed set of odds. Video Lottery Terminals allow players to play poker and blackjack type games. These VLTs are the fastest growing category of lottery games, providing state government with over 1.1 Billion dollars in gross revenue in 1997, an increase of 23.5 percent over the previous year (McQueen 1998).

The Massachusetts State Lottery offers a diverse array of games in their product portfolio. In 1974, the MSL revolutionized the lottery industry by being the first to introduce the $1 instant ticket.[2] The player knows immediately if they have won by scratching the ticket to reveal hidden prizes. **Instant tickets** account for approximately 65% of the total sales and maintain player interest by introducing new games with varied themes up to eight times a year. In 1992, the MSL began offering instant tickets available for $2, $3 and $5, allowing for larger jackpots. Prizes and odds vary significantly among the different tickets, however the overall odds of winning something are virtually the same, all hovering around 1 in 5.The Numbers Game was introduced in 1976. It is the oldest game still available by the MSL and yet remains consistently popular. Designed to recapture players of the illegal numbers games on the street, it allows for a range of betting options including choice of numbers, the type of bet and dollar mount. Winning numbers are drawn once a day, seven days a week.

In 1982 the MSL established the lotto style game **Megabucks**. Originally the player chose six numbers from a field of thirty for a chance at a jackpot that grew until it was won. As an effort to promote the potential of "roll-overs" and larger jackpots the field was increased to 36 in 1983 and then 42 in 1991. Neither of these efforts was able to help save the game from its negative growth rate. Megabucks is drawn twice weekly on Wednesday and Saturday. As a response to the public demand for substantial multi-million dollar jackpots, in 1987 the MSL launched **Mass Millions**. It is another lotto style game in which the player chooses six numbers from a field of 46 plus a seventh bonus number. The field was increased to 49 in 1991 and the prizes for the lesser winners were switched from fixed amounts to a pari-mutuel type payoff (later changed back to fixed in 1992). Winning numbers for Mass Millions are drawn on Mondays and Thursdays. **Mass Cash**, a third lotto style game, was introduced in 1991. All winners receive a one-time pay out of $100,000 after selecting five winning numbers from a field of 35. The odds are more favorable for the player in this game than for any other lotto game. Mass Cash drawings are held every Tuesday and Friday. **Pull Tabs** became available in 1992 only to specific agents mostly consisting of restaurants, bars and private clubs. A player must pull a break open card to reveal symbols instantly indicating a winning or losing ticket. Prices range from 50 cents to $2 for up to twenty different games.

The MSL collects 5% tax on gross receipts for Charitable gaming. Fundraisers run by charitable institutions, churches and schools must pay a levy to the state lottery to operate games of chance. A portion of that revenue goes to the local aid fund and a larger portion is added to the state's general fund. Legislation was passed in 1993 authorizing

[2] Tables illustrating the odds of winning the various games in the Massachusetts State Lottery product portfolio are contained in an appendix to this study.

the MSL to establish Keno. Another lotto style game, Keno differentiates itself from the others by having drawings approximately every five minutes. Players choose up to twelve numbers from 1 to 80. The computer randomly picks twenty winning numbers to display. Winners match some, all or none of the numbers shown depending upon how they bet. Despite the limited number of licenses available for agents to offer the game, Keno is second only to the instant tickets in terms of the lottery's highest sales generating products.

Hoping to recapture sales lost to PowerBall, the MSL joined five other states in 1996 offering The Big Game.[3] This lotto style game offers consistently higher jackpots than other lotto style games in the MSL product portfolio. The minimum jackpot generally hovers around $40,000,000. However, the odds of winning the jackpot are the highest of any game in the MSL product line. To win a player must choose the five winning numbers out of a field of 50 *and* the number of the "big money ball" out of a field of 36. The high odds of winning The Big Game directly contribute to frequent high "roll-over" jackpots that serve to attract the casual player. On April 13, 1999 the Big Game jackpot reached a phenomenal $190 million dollars. Drawings for the Big Game are held on Tuesdays and Fridays.

The above description of the game portfolio of the Massachusetts State Lottery provides several insights into the structural factors underlying lottery performance. There are generally considered to be ten structural characteristics common to all gambling activities. A large part of the fiscal success of the MSL must be attributed to the manipulation of two primary structural characteristics: Frequency of opportunities to gamble and payout interval. Increasing the frequency of opportunity to gamble is associated with the introduction of casino type games like Keno and Video Poker. A change in the frequency of on-line games from once or twice weekly lotto drawings, to Keno (every five minutes) and Video Poker (10-15 games a minute by a skilled player) has allowed lottery sales to dramatically increase in the 1990s. By creating a prize structure for its Instant games replete with lower tier prizes, the MSL minimized its payout ratio to allow for Instant game winners to immediately retrieve their winnings. Despite the preeminence of these two factors to both players and gambling operators, a third structural characteristic, the average cost of participating in a game, is the primary factor contributing to a pattern of sales growth for the Massachusetts State Lottery during the 1990s.

In 1992 the MSL introduced its first $2 Instant game ticket. In November 1992 the Massachusetts State Lottery marketed the first $5 Instant game. The evolution of the MSL's product line, with a focus on simultaneous marketing of a multiplicity (30-35) Instant games, were major structural factors contributing to the fiscal success of the MSL, the so called 'Massachusetts Miracle'. As the ensuing statistical analysis of the MSL demonstrates, the introduction of higher price Instant game tickets is the primary factor contributing to lottery growth during the 1990s. This study argues one of the primary

[3] The other states participating in the Big Game are Georgia, Illinois, Maryland, Michigan and Virginia.

methods by which the MSL can maximize revenues is to increase the average price of Instant game tickets.[4]

2.00 CASINO LEGALIZATION: THEORETICAL RATIONALES

New England gambling policy provides a fertile testing ground to ascertain the relationship between State lotteries success and casino gambling activity. The maturity of State lotteries, along with the recent proliferation of Indian gaming provides an opportunity to assess the impact casino expansion has on State lotteries. Moreover, the current debate over gambling policy in Massachusetts highlights an opportunity to examine the process of gambling policy diffusion between states. Walker's seminal study found one of the primary determinants of the diffusion of policy was that states were compelled to follow the lead of adjoining states who had already adopted an innovative policy (Walker 1969). This 'keeping up with the Jones' approach to public policy appears to be one of the primary rationales underlying state gambling policy (Berry and Berry 1990).

While Massachusetts policymakers mull over the expansion of gaming activity in the Bay State, New Hampshire lawmakers are contemplating adding video lottery terminals (VLTs) at Granite State racetracks to fund education. Supporters of video gaming in New Hampshire assert their plan could add $145 million a year to state coffers (Graham 1999). A Center for Policy Analysis study estimated Massachusetts residents currently wager approximately $105 million dollars annually at New Hampshire racetracks (Center for Policy Analysis 1999b). The addition of VLTs to the Granite State's gambling product portfolio has strident fiscal implications on the Commonwealth of Massachusetts. Given the outflow of capital from the Bay State to adjoining states gambling facilities, an examination of the impact casino legalization has on the Massachusetts State Lottery and public finance in Massachusetts is warranted.

The recent proliferation of casino gambling in the United States has generally been underwritten by one of four theoretical rationales: state fiscal stress, interstate tax competition, political feasibility and economic development (Furlong 1998). Fiscal stress has been proven to be an important causal factor leading to introduction of casino gaming in a number of states (Thompson 1994). Early adopters of casino gaming are able to extract profits from later adopting states, resulting in importing of revenue from neighboring states. The narrow incidence of 'voluntary' taxes associated with casino gaming makes them a politically expedient method of raising revenues for reelection minded state legislators. Finally, casino gaming has been utilized to stimulate state and local economic development in terms of job creation, import of investment capital and a more favorable economic climate. These four theoretical rationales have served as the impetus for casino legalization campaigns across the United States. Whichever rationale is utilized, commercial casino gaming has provided an additional stream of revenue to state government. This study will focus on the revenue and interstate tax competition rationales applicability to the current debate over casino legalization in Massachusetts.

[4] A current research project entails an analysis of the average price of Instant game tickets at Lottery Agents throughout Southeastern Massachusetts to determine if there is any relationship between this structural factor and the income profile of communities throughout the region.

2.10 CASINOS AND GOVERNMENT REVENUE

One of the primary arguments raised in the debate over casino legalization is this new form of gambling activity will adversely effect state lottery sales. A 1996 MSL commissioned study argued lottery sales would be cannibalized by approximately 16 percent if casino gaming were introduced to Massachusetts. In other words, about 16 percent of casino and gaming device spending would have otherwise been spent on MSL games (Gaming Strategies Group 1996). The scenarios envisioned by the above study argued the cumulative impact on MSL sales would range from -9.1 to 15.0 percent. This MSL commissioned study concluded this number seemed 'reasonable given the experience of other states'. An analysis of the 'experience of other states' reveals in the aftermath of the introduction of casino gambling a number of state lotteries have enjoyed sales increases. Moreover, a bifurcated approach to analysis of the effect the introduction of casino gaming has on state lottery performance which separates the lottery sales from lottery generated revenues is called for.

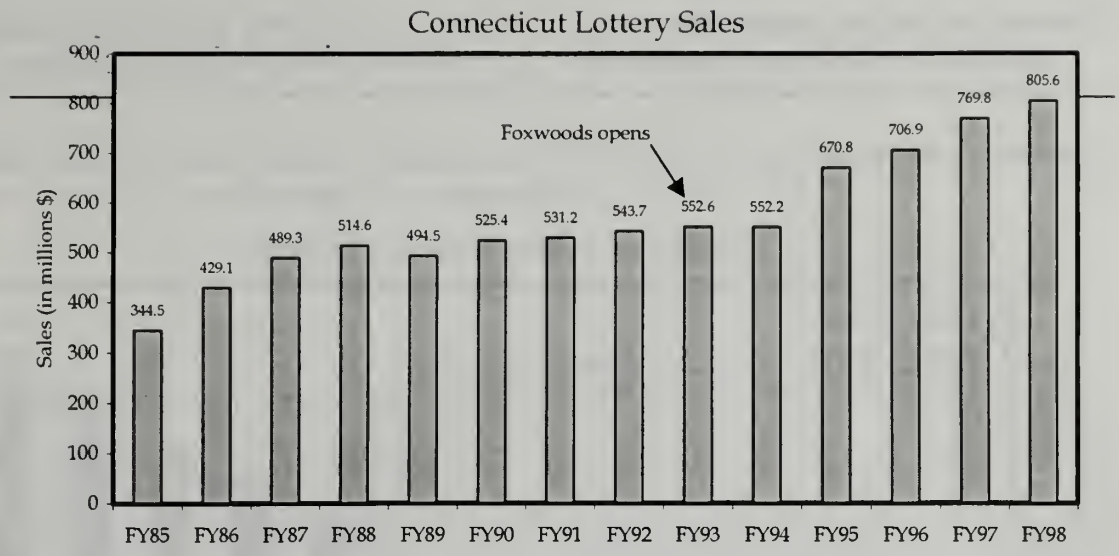
While state lottery sales can be construed as a measure of lottery performance, the bottom line for Massachusetts state legislators bent on maximizing profits for their constituents as measured by Direct Local Aid is better understood by a focus on lottery generated revenues, not sales. A narrow focus on sales tends to underplay several factors which may impact lottery performance. In particular, the implicit tax rate associated with lottery products, along with the effect advertising has on lottery performance, effect the success of state lottery sales. A more accurate picture of the relationship between casino legalization and state lottery performance is best captured by an analysis of the fiscal impact this relationship has on government generated revenue.

This study finds that in each and every of the nine states which have legalized casino gaming, gambling generated revenue (the sum of lottery and casino monies accruing to the state) has increased since the introduction of casino gaming.[5] Two related statistical measures, average percentage increase in sales and average dollar increase in sales, aid in capturing the fiscal impact the addition of casino gaming has on state coffers. Moreover, an analysis of the impact the advent of casino gaming in Connecticut had on the performance of the Connecticut State Lottery sheds light on the fact state lotteries and casino gaming can coexist and flourish within the same jurisdiction.

2.11 Connecticut

A recent Center for Policy Analysis study estimated Massachusetts residents spend nearly 600 million dollars annually at Foxwoods and the Mohegan Sun (CPA 1999). An assessment of the impact casino legalization had on the Connecticut State Lottery may provide guidance to Massachusetts policymakers considering casino legalization. A recent comprehensive study of legalized gambling in Connecticut concluded that while there may be some substitution effect with regard to consumer spending between lottery games, there

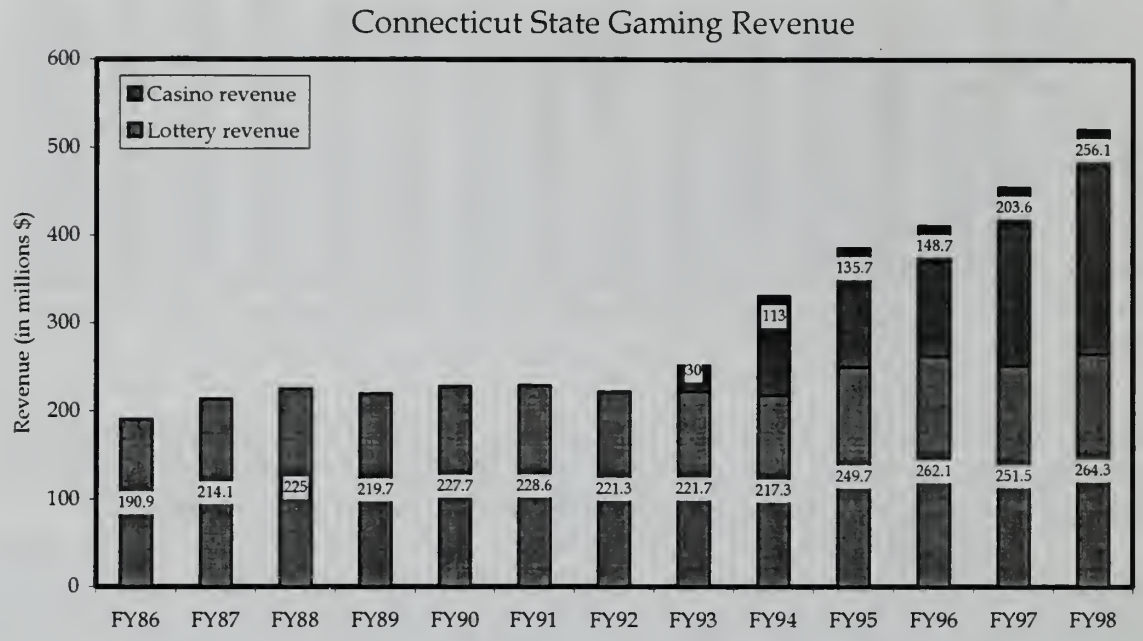
[5] This study replicates the methodology employed by a previous study (Harrahs 1996). When there was a conflict between the revenue figures of the previous study and those obtained from state agencies, this study utilized the revenue amounts derived from official state documents.



appears to have been no effect on lottery sales as a result of the introduction of casino gambling (WEFA 1996, 1-26). The below chart graphically illustrates the upward sales trend for the Connecticut State Lottery since the introduction of casino gambling.

A closer examination of the above data reveals the Connecticut State Lottery's annual rate of sales increase since the introduction of casino gaming has been 7.1 percent. This post-casino introduction sales trend accounts for an increase of 43.6 million dollars annually. These findings have significant implications within the current Massachusetts debate over casino gambling. While Foxwoods has become the most profitable gambling enterprise in the United States, and the Mohegan Sun is planning a $950 million dollar expansion, Connecticut Lottery sales have continued to increase by an annual average of over 7% since the inception of casino gambling. If the state of Connecticut's lottery can continue to grow in the aftermath of the introduction of one of the world's most profitable casinos, it is plausible to assume the Massachusetts State Lottery can enjoy the same type of sales growth.

While the Connecticut State Lottery Corporation has continued to show significant sales growth after the introduction of casino gaming, a narrow focus on lottery sales does not accurately portray the contribution the lottery makes towards state revenue. In fiscal year 1998, the Connecticut State Lottery contributed over $264 million dollars to the state's general revenue fund. It should be noted this fiscal contribution was larger than that contributed by the two Native American gaming facilities, Foxwoods and the Mohegan Sun, located within the borders of Connecticut. The two Indian casinos contributed $256.1 million to state coffers during the same time period. The below graph illustrates a pattern of steady growth of gambling generated revenue for Connecticut since the introduction of casino gaming.

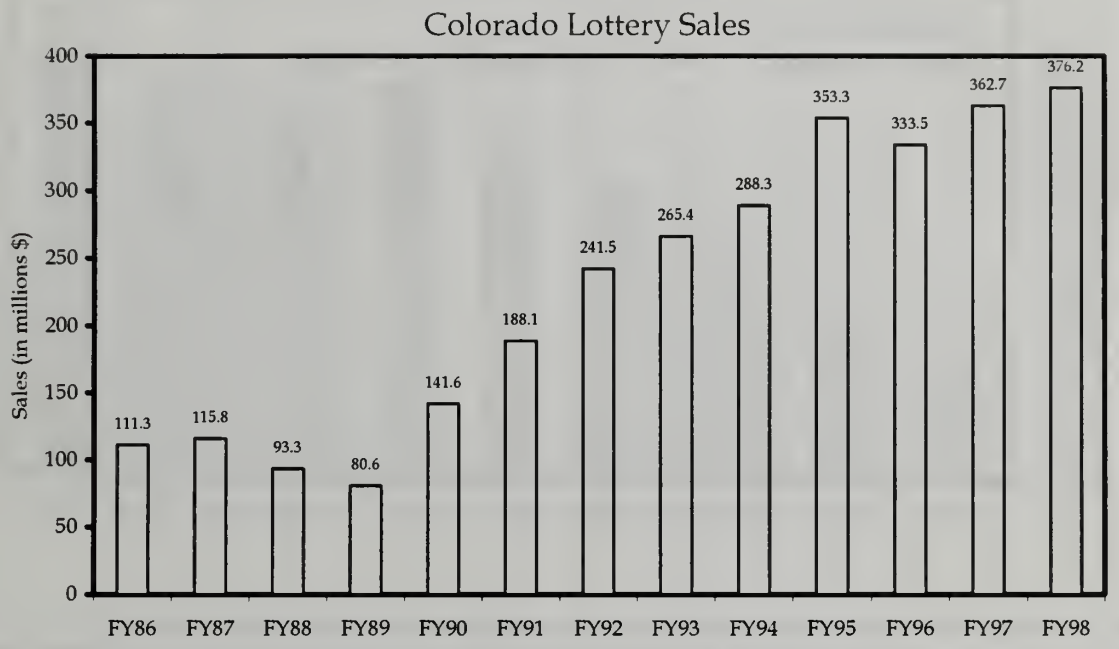


Since the inception of casino gaming in Connecticut during fiscal year 1993, gambling generated revenues have increased at an annual rate of 15.9 percent. During fiscal year 1998, the state lottery and Indian casinos contributed over $520 million in revenue to Connecticut state finance (Department of Special Revenue 1999). This finding has strident implications for Massachusetts state legislators contemplating the introduction of casino gaming. While it may be difficult to replicate the fiscal success of Foxwoods, it is noteworthy that the Connecticut State Lottery has continued to grow since the advent of casino gaming. The discussion of the following states mirrors the experience of Connecticut in terms of lottery sales and gambling generated revenue growth since the introduction of casino gaming.

2.12 Colorado

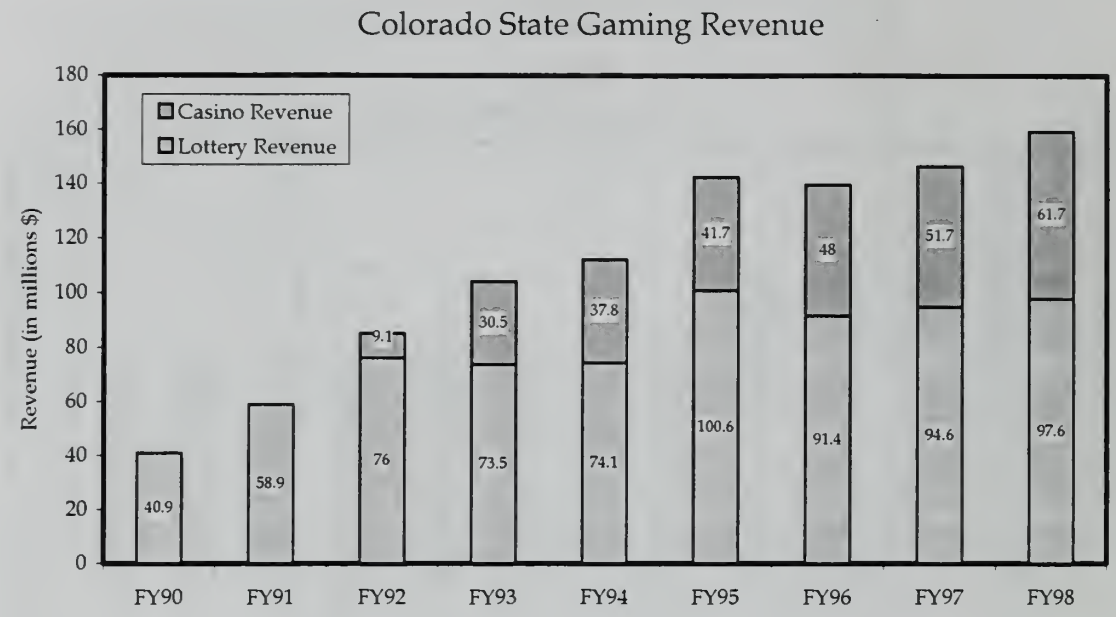
In November 1990 the voters in the State of Colorado approved a constitutional amendment permitting limited stakes gaming in the mountain towns of Black Hawk, Central City and Cripple Creek. "Limited stakes gaming" is defined as a maximum single bet of $5 on slot machines, live blackjack and poker games. Slot machines in Colorado may encompass video poker, blackjack and keno machines. Despite the proliferation of casino gaming, the Colorado State Lottery has continued to enjoy sales growth in the aftermath of the legalization of casino gaming. Since the inception of the Colorado State Lottery (CSL) in the early 1990s, lottery generated revenues have added over $ 935 million to state coffers. During fiscal year 1998 the CSL generated sales of $376 million, resulting in a contribution of $95 million dollars of revenue to state finance. Colorado provides an opportunity to examine the effect limited stakes casino gambling has on

lottery sales. The graph below illustrates that the Colorado State Lottery has continued to grow despite the introduction of casino gambling.



An analysis of the above data indicates that during the period from 1986 until the legalization of casino gambling in 1990, the Colorado State Lottery enjoyed an annual rate of sales increase of 19.72 percent, accounting for an annual dollar growth of $15.4 million. Since the inception of casino gaming, the Colorado State Lottery is averaging sales growth of 10.9 percent annually. While the rate of sales increase has slowed since the inception of casino gaming, the average annual dollar growth in Colorado lottery sales has reached $26.87 million, a significant amount in a state of 3.7 million people. The Colorado State Lottery has continued to grow in the aftermath of the introduction of casino activity. This is especially noteworthy given the prolific rise in the number of casinos in Colorado. Over 50 gaming establishments currently operate in Black Hawk, Central City and Cripple Creek.

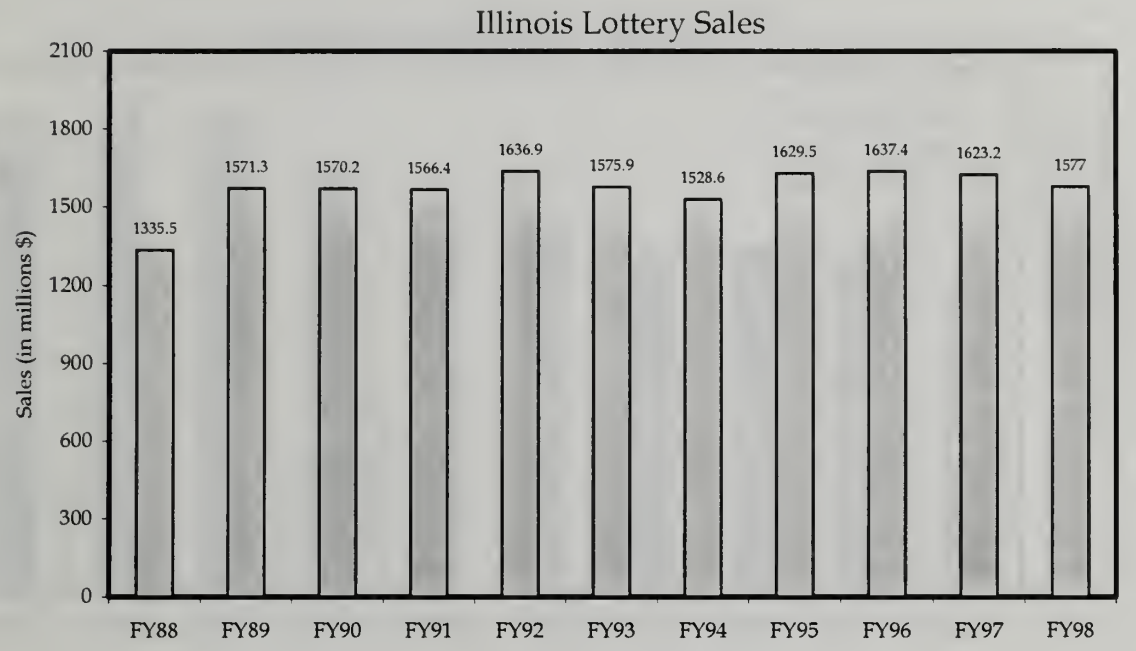
Casino gaming has also had a positive influence on Colorado state finance. Since the inception of casino gaming October 1991, casinos have generated nearly $250 million in gaming tax revenues to the state. A portion of this money (28%) has been used to fund state historical restoration projects, especially in the historic mining towns in which the casinos are located (Division of Gaming & Gaming Commission 1997). However, the largest recipient of this fiscal largesse has been the state general fund, enhancing legislative budgetary discretion (49.8%). During fiscal year 1998 gaming fund distribution in Colorado was over $61 million dollars. The below graph illustrates the growth in gambling generated revenue since the inception of casino gaming in Colorado.



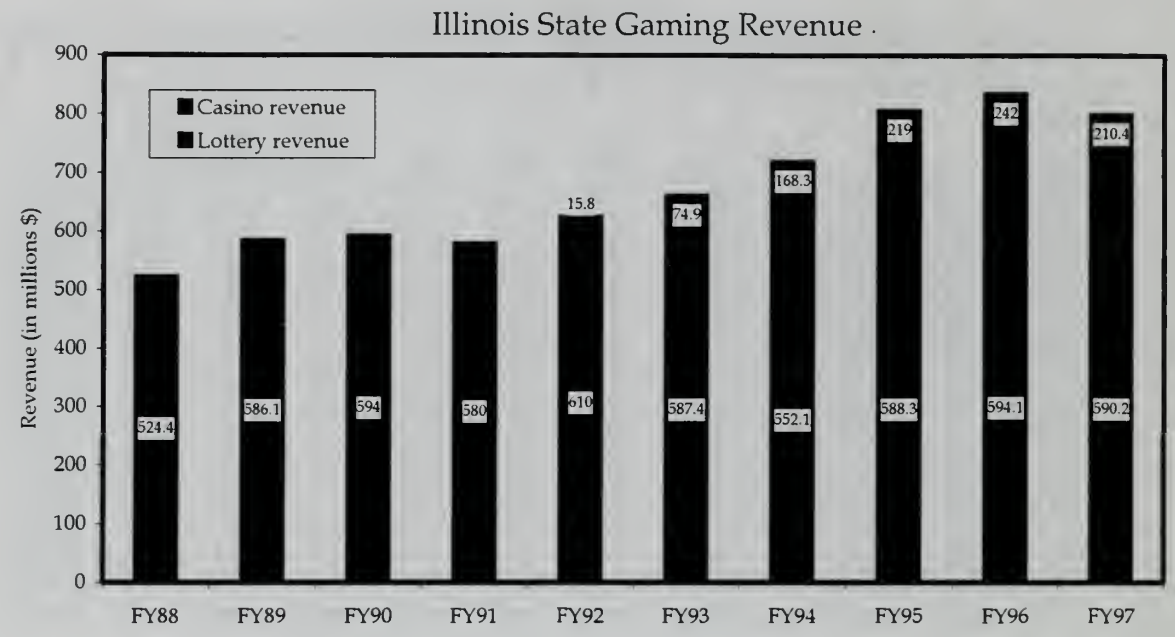
During fiscal year 1998, the state lottery and casinos contributed over $159 million dollars to state finance in Colorado. Since the inception of casino gaming during fiscal year 1992, gambling generated revenue has enjoyed an annual average increase of 11.5 percent. Colorado provides another example where state lotteries and casino gaming and coexist and flourish.

2.13 Illinois

The state of Illinois was one of the lottery adopting states during the modern era. Since its introduction in 1974, the Illinois State Lottery has contributed $8.91 billion dollars to government coffers. Riverboat gaming was introduced to the Illinois gambling landscape during September 1991. Currently there are nine licensed riverboat gaming establishments operating in Illinois. After administrative expenses are paid, monies collected from riverboat gaming are appropriated to the state Educational Assistance Fund.



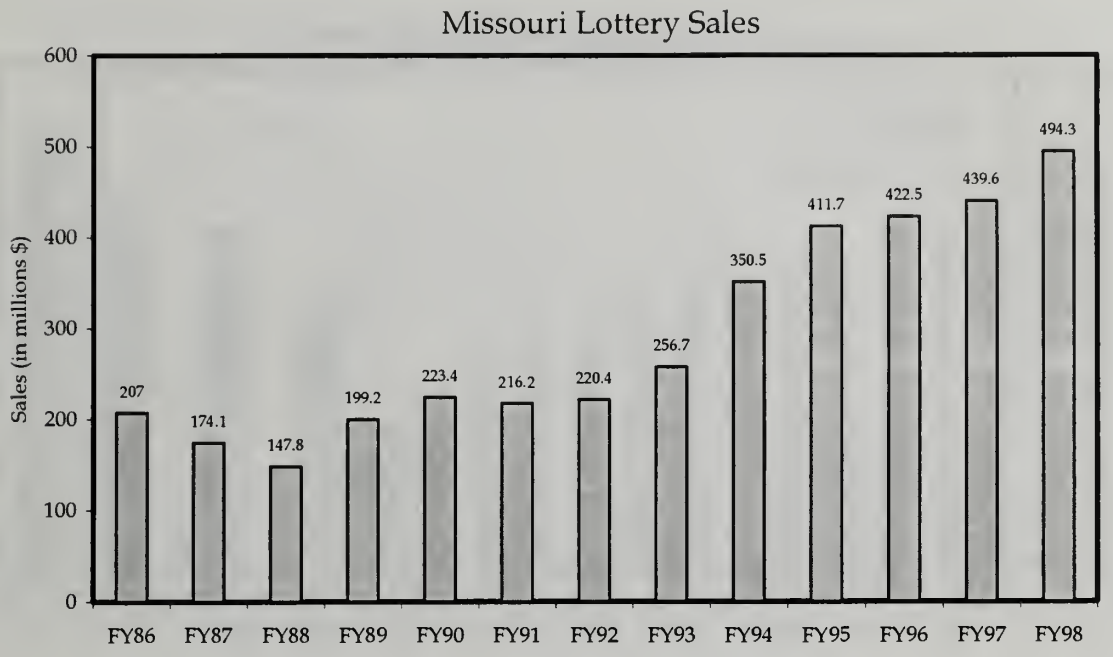
The above chart illustrates the stable nature of lottery sales in the aftermath of the introduction of riverboat gaming. On an annual basis, lottery sales have increased .2 percent, accounting for an average of $1.97 million in additional sales. However, this pattern of stable lottery sales, combined with the advent of riverboat casinos, has led to an increase in the amount of monies these two gambling sources generate for state coffers.



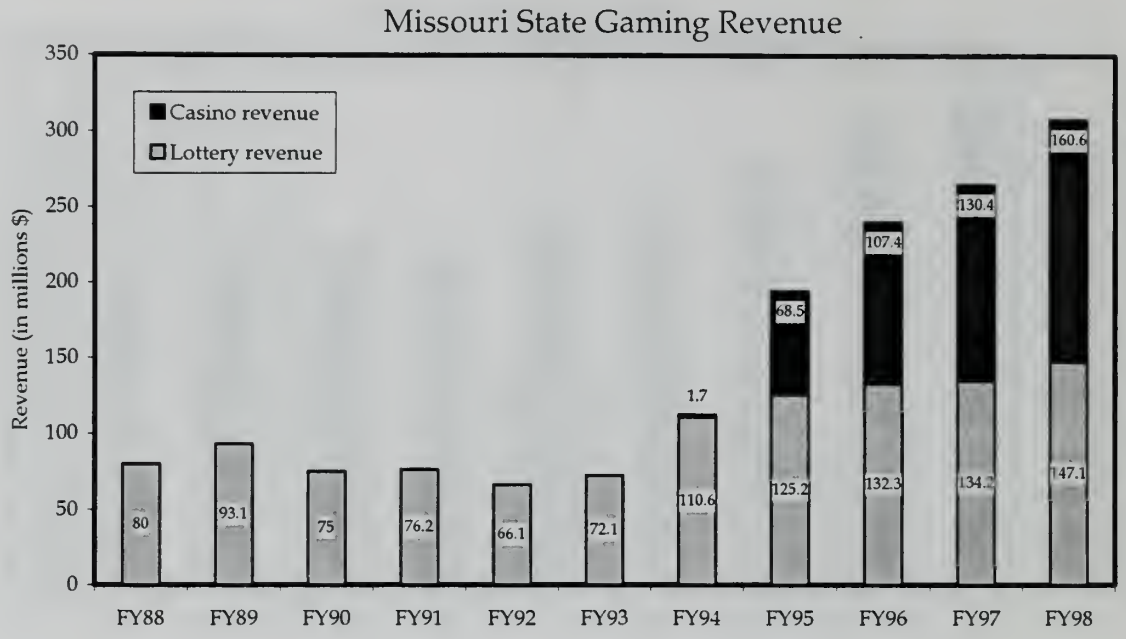
Since the introduction of casino gaming, Illinois gambling generated revenue has increased at an annual rate of 5.2 percent. During fiscal year 1997, the state lottery and riverboat casinos generated over $800 million for state coffers. While the Illinois State Lottery did not enjoy the sales growth of Connecticut or Colorado, it should be noted that gambling generated revenues have increased from $580 million the year prior to the introduction of casinos to their present levels. Illinois provides another example of a state where lotteries and casinos can coexist and prosper.

2.14 Missouri

The state of Missouri provides another example of a state where lottery sales have increased since the introduction of casino gaming. Since its inception in 1985, the Missouri Lottery has contributed over $3.7 Billion dollars to education programs in the state. Riverboat gaming is a relatively recent addition to the gambling landscape in Missouri. The below chart illustrates a pattern of significant sales growth for the Missouri Lottery since the introduction of casino gaming.



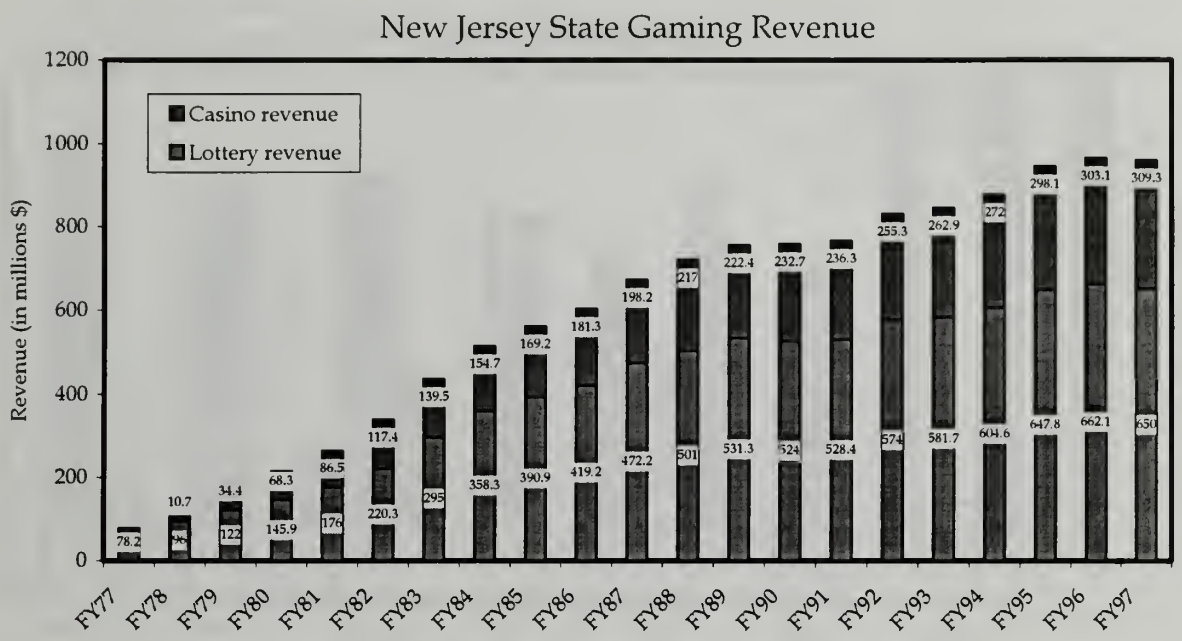
The Missouri Lottery has enjoyed an annual average rate of growth of 30.7% since the introduction of casino gaming. During fiscal year 1998 the Missouri Lottery generated approximately 10 percent more in proceeds for education programs than any previous year in the Lottery's 12 year history. Combined with the sizable fiscal contribution of riverboat gaming, these two sources contributed over $307 million in dollars to Missouri government coffers in fiscal year 1998.



The discussion of the above states provides several examples illustrating lottery sales can continue to grow in the aftermath of the introduction of casino gaming. Moreover, the above states provide a range of gambling experiences (mature vs. young lotteries, Indian vs. commercial casinos) which buttress the claim that state lotteries and casinos can coexist and prosper. However, a narrow focus on the question of lottery sales growth tends to obfuscate the fiscal contribution lotteries in tandem with casino gaming makes towards state finance. The below discussion persuasively illustrates how gambling generated revenue has increased in each and every state in which commercial casinos have been introduced.

2.15 New Jersey

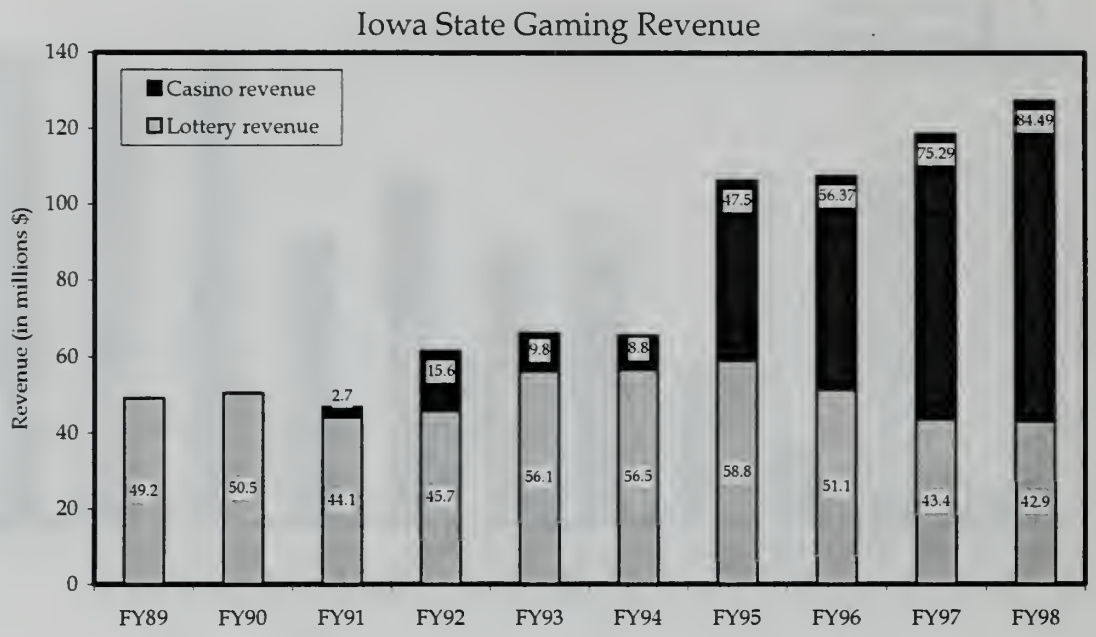
The state of New Jersey provides another example of a mature lottery being able to coexist with casino gaming. A common misconception concerning the New Jersey gambling scene is that the Garden State is dominated by the Atlantic City casino presence. In fact, a similarity can be drawn between New Jersey and Connecticut, as in both states the lottery contributes more to state coffers than does the more visible and glitzy casino gaming presence. During fiscal year 1997, the New Jersey Lottery contributed more than $650 million to State Education and Institutions. Since its inception over 27 years ago, the New Jersey Lottery has contributed $8.8 Billion to state coffers. Conversely, the 8 percent tax on gross revenues from casinos in New Jersey funds programs benefiting senior citizens and the disabled. During fiscal year 1997, the Casino Revenue fund contributed over $309 million to state finance.



2.16 Louisiana

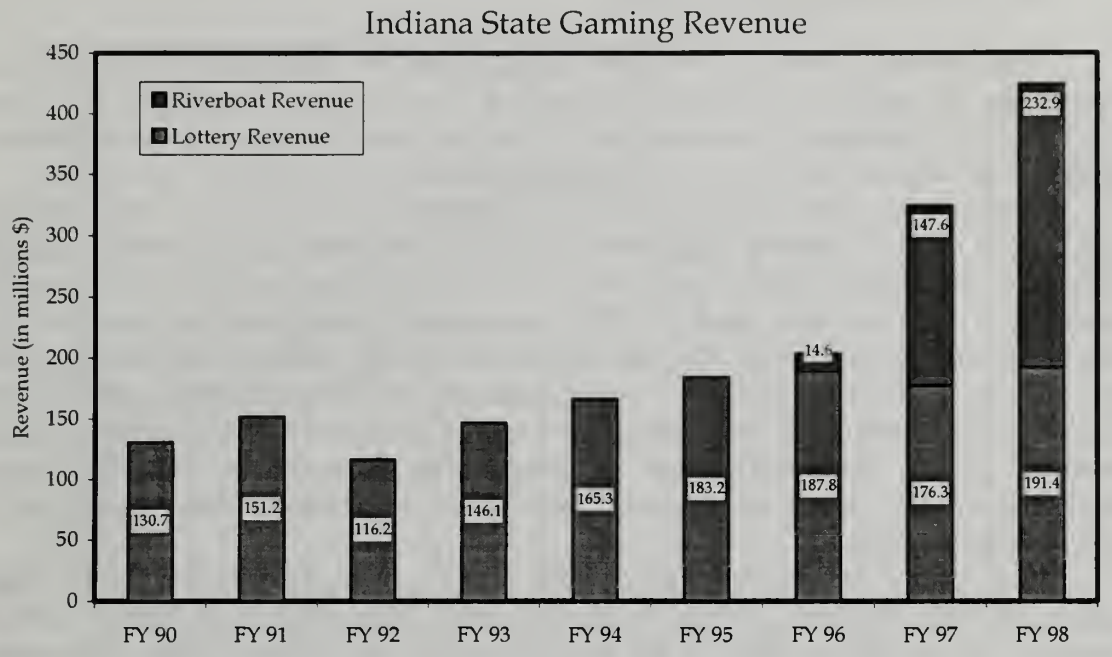
Another model of state gambling policy is provided by an examination of the state of Louisiana. This state provides a hybrid trifurcated model of state gambling policy featuring a lottery, video poker (operated by the state police), and commercial gaming.[6] The state lottery was introduced during fiscal year 1992. Video poker and casino gambling were added the following two years. During fiscal year 1998, these three gambling sources generated $506 million in revenue for state coffers. Louisiana has enjoyed annual average revenue growth of 18.4 percent since the inception of casino gaming in 1994.

[6] It should be noted that the predominant model of state gambling policy features operation of video poker by the state lottery. South Dakota, Oregon, West Virginia, and Delaware adhere to this model.



2.19 Indiana

The state of Indiana provides the final example illustrating the positive fiscal impact the introduction of casino gaming has on public finance. The Hoosier Lottery has contributed over $1.5 Billion to the state of Indiana general fund since its inception. Riverboat casinos were added to the Indiana gambling product mix during fiscal year 1996. During fiscal year 1996, the Hoosier Lottery and riverboat casinos contributed over $424 million dollars in revenue to Indiana state coffers.



Summary

The above analysis unequivocally demonstrates the introduction of commercial casino activity has positive implications on state finance, as measured by growth in gambling generated revenue. In each of the nine states in which commercial casinos have been introduced, state revenue has been positively effected. It is interesting to note that several states have actually enjoyed lottery sales increases since the introduction of casino activity.

One of the axioms concerning gambling activity is 'there is no such thing as a sure thing'. Despite the verity of the above analysis, state legislators in the Commonwealth have become dependant on the fiscal largesse provided by the Massachusetts State Lottery. MSL generated profits are the primary funding source for Direct Local Aid, which serves as the lifeblood for cities and towns throughout the state. All recent challenges to the fiscal autonomy of the Massachusetts State Lottery over the gambling landscape in the Bay State has been met by stiff resistance. However, this protective focus generally centers on an analysis of lottery sales, not revenues. While it can be argued that the Massachusetts State Lottery, by virtue of its maturity, marketing strategy, product line, and focus on efficiency is unique, the evidence suggests that the MSL can coexist with commercial casinos in providing an increase in gambling generated revenue for state government. The experience of other states demonstrates the distinct possibility that not only will gambling generated revenues increase after the introduction of casino gaming, but that MSL sales may increase as well.

3.00 THE MASSACHUSETTS STATE LOTTERY: STATISTICAL ANALYSIS

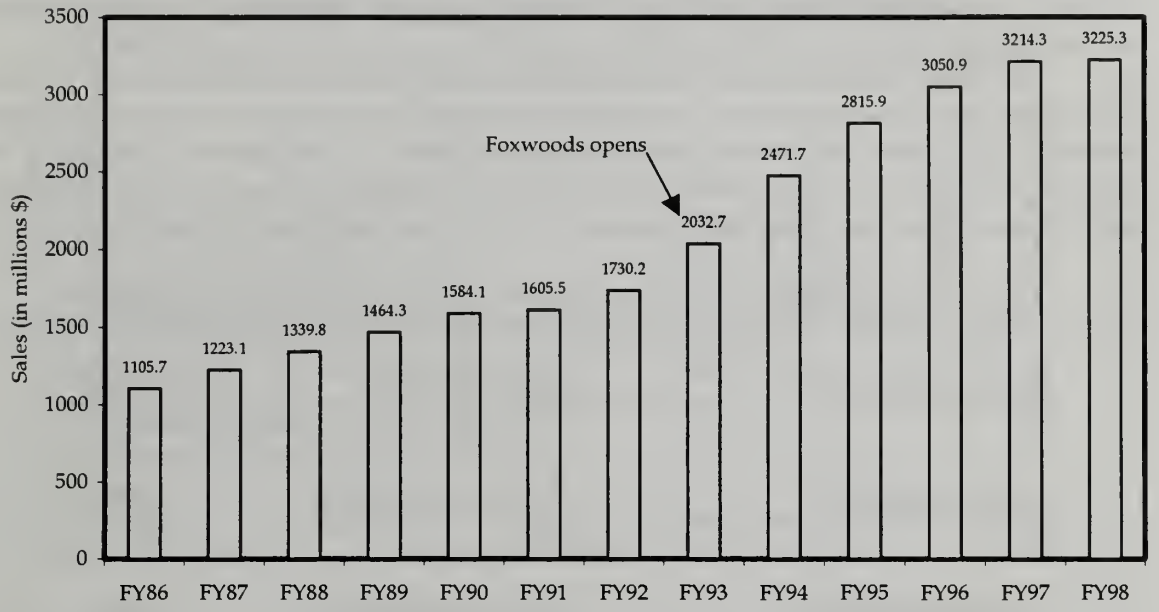
The current debate over casino legalization in Massachusetts provides an opportunity to assess the recent development of New England gambling policy. Given the central role state lottery revenue plays in the Bay State, a thoughtful consideration of the role of the Massachusetts State Lottery plays within public finance is warranted.[7]

Casino opponents have argued the legalization of casinos has negative fiscal implications on state finance. The previous section illustrates that gambling generated revenue, as measured by the sum of lottery and casino revenue accruing to the state, has increased in each and every state in which commercial gaming has been introduced. It may be difficult to extrapolate from the experiences of other states whose lottery product portfolios, maturity of the product line and marketing strategies are vastly different from those of the Massachusetts State Lottery. However, a comparative focus on New England gambling policy, particularly that of neighboring Connecticut, provides several interesting insights which may guide Massachusetts legislators in their search for the 'best' gambling policy.

The history of the Connecticut State Lottery since the introduction of casino gaming in 1992 provides a salient regional example illustrating how lottery sales can increase after casinos are added to the gambling landscape. Massachusetts policymakers should ponder the validity of previous studies arguing MSL sales will decline if casinos are added to the gambling product portfolio in Massachusetts (Gaming Strategy Group 1996b). Moreover, any argument centering on the assertion the introduction of casino gambling in Connecticut had a negative fiscal impact on the Massachusetts State Lottery is not rooted in reality. The Massachusetts State Lottery has grown at a annual rate of 11.2 percent since the introduction of casino gambling in Connecticut.

[7] Please note the limitations of the data utilized in this analysis. Despite repeated requests, the MSL did not provide the sales data necessary to complete this project in a timely fashion. It was only after the intervention of elected officials that the MSL provided what could at best be described as 'sketchy sales data. A number of

Massachusetts Lottery Sales



The above chart indicates a pattern of steady sales growth for the Massachusetts State Lottery in the period since the introduction of casino gambling in Connecticut. An analysis of the pre-casino and post-casino sales records indicates lottery sales growth has grown since the introduction of casino gaming at Foxwoods and Mohegan Sun. MSL sales from August 1989 to the introduction of casinos in 1992 grew at an annual rate of 7.8%, or $104.1 million dollars a year. Since the legalization of casinos in Connecticut to the New England gambling landscape, the rate of growth for the Massachusetts State Lottery has increased to 11.2% annually. While it may be inaccurate to attribute this pattern of growth to the introduction of casino gambling, the above chart aptly illustrates the fact MSL sales have not been adversely effected by Foxwoods and the Mohegan Sun gaming facilities in neighboring Connecticut.

In order to assess the performance of the Massachusetts State Lottery in the 1990s, this study attempts to isolate the impact a range of policy interventions have on MSL performance. This study attempted to ascertain the effect of several policy interventions on MSL performance: (1) the introduction of casino gaming in Connecticut in 1992. (2) The introduction of higher priced instant tickets in 1993. (3) Limitations placed on lottery advertising in 1994. Statistical analysis demonstrates the primary intervention effecting MSL performance is not the introduction of casinos to the New England gambling landscape. Instead the primary determinant of MSL sales 'success' was the introduction of higher priced instant tickets in 1992. Given the centrality of Instant game sales to the MSL 'bottom line', this study focuses on the effect the above policy interventions have on lottery performance.

The study utilized correlation matrices to ascertain the level of dependency of total MSL sales on Instant game sales. Several interesting relationships can be ascertained

via an analysis of a correlation coefficient matrix for Massachusetts State Lottery products. A correlation matrix can shed considerable light on questions of product substitution and the interrelationships between lottery products. This aggregated approach to analysis of lottery sales performance highlight the effect policy interventions such as the introduction of higher priced instant tickets have on lottery performance.

The study utilized MSL monthly sales data for the period January 1989 to November 1998 to ascertain this relationship. A difference in the correlation coefficients between total sales and Instant game sales illustrates a fundamental change in the product portfolio. The below table illustrates the relationship between Instant game sales and MSL total sales and the effect of the above policy interventions on this relationship.

TABLE ONE. INSTANT GAME-TOTAL SALES CORRELATIONS

Pre Foxwoods	Post Foxwoods	Change
.81**	.97**	+.16
Pre $1 plus Instant	**Post $1 plus Instant**	**Change**
.43*	.98**	+.55
Pre Advertising Cut	**Post Advertising Cut**	**Change**
.95**	.97**	+.03

As the above table demonstrates the policy intervention having the greatest effect on the relationship between Instant game and MSL total sales is the introduction of higher priced Instant Game tickets in 1992.[8] The change in the correlation coefficient for the relationship between Instant Game and MSL total sales before and after the introduction of higher priced Instant tickets was .55, over 300% larger than either of the other two policy interventions examined. Given this significant change in the relationship between the flagship Instant game and MSL total sales, a detailed examination of the effect the introduction of higher priced Instant game tickets had on MSL performance is warranted.

[8] Correlation matrices for the pre and post Foxwoods time series, and the pre and post advertising cut time series, are located in an appendix to this report.

TABLE 2. PRE +$1 INSTANT TICKETS CORRELATION COEFFICIENT MATRIX, MASSACHUSETTS STATE LOTTERY

	INST	NUMB	MCAS	PTAB	MEGA	MMIL	TSAL
INST		-.11	.35	-.11	-.40*	.01	.43*
NUMB	-.11		-.35	-.78	.61**	-.05	.56**
MCAS	.35	-.35		-.69	-.46	.05	.08
PTAB	-.11	-.78	-.69		-.75	.998*	.02
MEGA	-.40*	.61**	-.46	-.75		.08	.29
MMIL	.01	-.05	.05	.998*	.08		.62**
TSAL	.43*	.56**	.08	.02	.29	.62**	

*. Correlation is significant at the 0.05 level
**. Correlation is significant at the 0.01 level

INST = Instant NUMB = Numbers MCAS = Mass Cash PTAB = Pull Tabs
MEGA = Megabucks MMIL = Mass Millions TSAL = Total Sales

TABLE 3. POST +$1 INSTANT TICKET CORRELATION COEFFICIENT MATRIX, MASSACHUSETTS STATE LOTTERY, 1992-98

	INST	BIGA	NUMB	MCAS	KENO	CHAR	BEAN	PTAB	MEGA	MMIL	TSAL
INST		.04	-.24*	-.53**	.80**	-.14	-.32*	-.19	-.64**	.01	.98**
BIG	.04		.09	-.16	.17	-.27	-.26	.24	.04	.24	.17
NUM	-.24*	.09		.78**	-.16	.40**	.30*	.30**	.51**	.33**	-.15
MCAS	-.53**	-.16	.78**		-.58**	.52**	.35*	.49**	.81**	.39**	-.48**
KENO	.80**	.17	-.16	-.58**		-.23	-.38**	-.61**	-.71**	-.19	.81**
CHAR	-.14	-.27	.40**	.52**	-.23		.61**	.25	.47**	.12	-.08
BEAN	-.32*	-.26	.30*	.35*	-.38**	.61**		.16	.38**	.03	-.27
PTAB	-.19	.24	.30**	.49**	-.61**	.25	.16		.45**	.38**	-.21
MEGA	-.64**	.04	.51**	.81**	-.71**	.47**	.38**	.45**		.35**	-.58**
MMIL	-.01	.24	.33**	.39**	-.19	.12	.03	.38**	.35**		.13
TSAL	.98**	.17	-.15	-.48**	.81**	-.08	-.27	-.21	-.58**	.13	

*. Correlation is significant at the 0.05 level
**. Correlation is significant at the 0.01 level

INST = Instant BIGA = Big Game NUMB = Numbers MCAS = Mass Cash
KENO = Keno CHAR = Charity BEAN = Beano PTAB = Pull Tabs
MEGA = Megabucks MMIL = Mass Millions TSAL = Total Sales

An analysis of the above correlation matrices to isolate the relationship between games in the Massachusetts State Lottery product portfolio reveals the effect changes in the structural characteristics of games, specifically the introduction of higher priced instant games tickets, has on MSL performance. As was discussed above, Instant game

sales are highly correlated with MSL total sales (.98, statistically significant at the .01 level). Additionally, the addition of Keno to the MSL product line after the introduction of higher priced instant tickets has contributed to that product also being highly correlated with MSL total sales (.81, statistically significant at the .01 level). While the positive effect that higher priced Instant tickets and the introduction of Keno have on the MSL 'bottom line' may be obvious, a close examination of the above correlation matrices highlights several negative relationships which may be adversely effecting Massachusetts State Lottery performance. In particular, it should be noted that both Mass Cash and Megabucks, two of the four lotto style games operated by the MSL, are negatively correlated with total sales (-.48 and -.58, statistically significant at the .01 level).

As charts of the annual sales record of the individual products within the MSL game portfolio demonstrate, Mass Cash and Megabucks are suffering from a continual pattern of sales decay over the last decade. Given this pattern of decreasing sales, state officials should consider eliminating these products from their game portfolio. While this may leave a 'hole' in the MSL product line, with regard to several days of the week not having a lotto style game drawing, in the real world products like Megabucks, which has suffered annual average sales decreases of over 10 percent the last decade, would be unceremoniously shed from the product line. Moreover, Megabucks is negatively correlated with Instant Game and Keno sales (-.64 and -.71, statistically significant at the .01 level). Given the centrality of lottery generated profits to Direct Local Aid in the Commonwealth the protective mentality of state legislators towards the MSL is easy to understand. However, a legislative strategy overlooking the negative fiscal repercussions of products suffering from a steady pattern of decaying sales is not in the best interest of the citizens of Massachusetts. State officials should seriously consider eliminating Megabucks and Mass Cash from the MSL sales portfolio.

Several other interesting insights can be gleaned from a comparison of the above correlation matrices. In particular, one should note the decreasing dependency of the MSL on both the Numbers and Mass Million games. The change in the correlation coefficients between the pre and post +$1 Instant game series is as large as that brought forth by the introduction of higher priced Instant tickets on MSL total sales (-.71 and -.57, respectively, versus .56 for Instant games). After analysis of the above empirical data, it becomes apparent that the introduction of higher priced Instant tickets in 1992 had a significant and lasting effect on a number of interrelationships between products in the MSL game portfolio.

One of the fundamental issues confronting state legislators as they attempt to formulate future gambling policy for the Commonwealth centers on the related topics of substitution and saturation. *Substitution* refers to the question of whether spending on one type of gambling activity can be diverted to another form of gambling. Casino opponents argue that the introduction of casino gambling into Massachusetts may have a negative fiscal impact on existing forms of gambling, especially the Massachusetts State Lottery. The related concept of *saturation* argues that all consumer products, including gambling products, follow a product life cycle including four phases: introduction, growth, maturity and decline. Saturation refers to the situation when sales of a lottery product or wagering on a particular form of gambling peak or flatten (WEFA 1996, Appendix H-1).

This paper argues there is little substitution effect between state lotteries and casinos. The reality is there is far more substitution between lottery products than there is between lotteries and casinos. This claim is consistent with the results of an earlier study in Connecticut (WEFA 1996). That study found that while there was some substitution of spending between lottery games, particularly between Instant Lottery sales from Daily Numbers and Play 4, there appears to be no effect on lottery sales as a result of the introduction of casino gaming (WEFA 1996, 1-26). This study asserts, based on the above statistical analysis, that there is some substitution within the MSL product line, particularly between Instant games from Megabucks and Mass Millions. Additionally, given the sales record of Instant game sales in Connecticut after the introduction of casino gambling, a similar scenario in which the flagship product of the MSL, Instant scratch-off games, continues to grow after the introduction of casino gaming is a reasonable scenario.

A constant thread through the academic literature focusing on gambling policy asserts that lotteries and casinos provide a vastly different gaming framework. From a government revenue perspective and that of the gambler, the implicit tax rate for the two types of gambling activity is quite different (40 vs. 5 percent). Moreover,

> Casinos have live-action games in which players participate; lotteries do not provide this scenario. This distinction is key to why casino gambling is rational behavior, and it cautions against treating both forms of gambling in the same way. An analysis that unthinkingly equates the two is flawed at the outset. (Marfels 1998, p. 418).

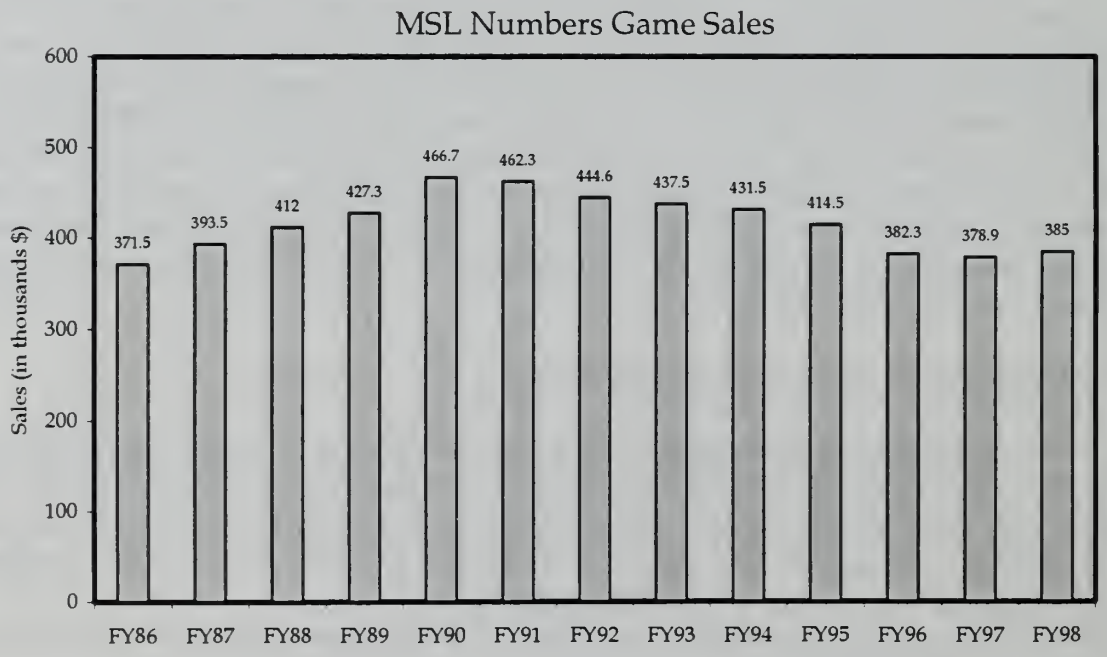
The above statistical analysis suggests the reluctance of state legislators to rationally contemplate the introduction of casino gaming in Massachusetts due to the perceived threat to the state lottery may not be rooted in empirical reality. Moreover, if policy makers are bent on improving lottery performance, an assessment of the vitality of existing lottery games, particularly Megabucks and Mass Millions, is warranted. The evidence overwhelmingly suggests that lotteries and casinos can coexist and prosper in the same jurisdiction. Given the overarching goal of state legislators to maximize revenue for their constituents in the form of Direct Local Aid, the revenues generated from casino activity can significantly augment the weighty fiscal contribution the Massachusetts State Lottery makes to public finance.

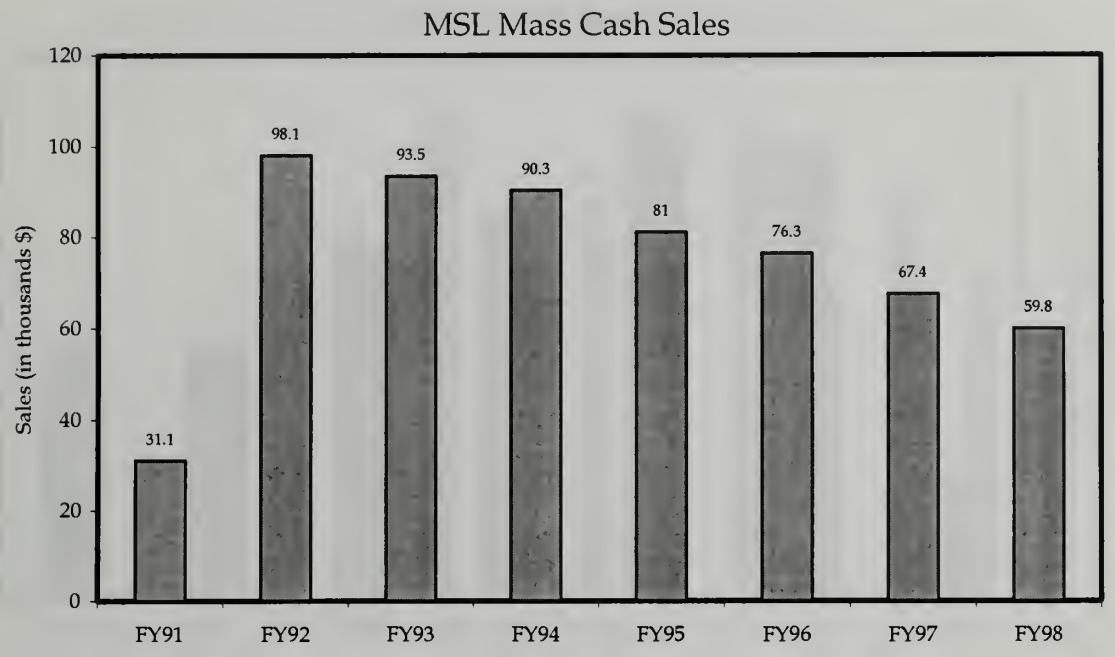
3.10 GAME BY GAMES SALES HISTORY

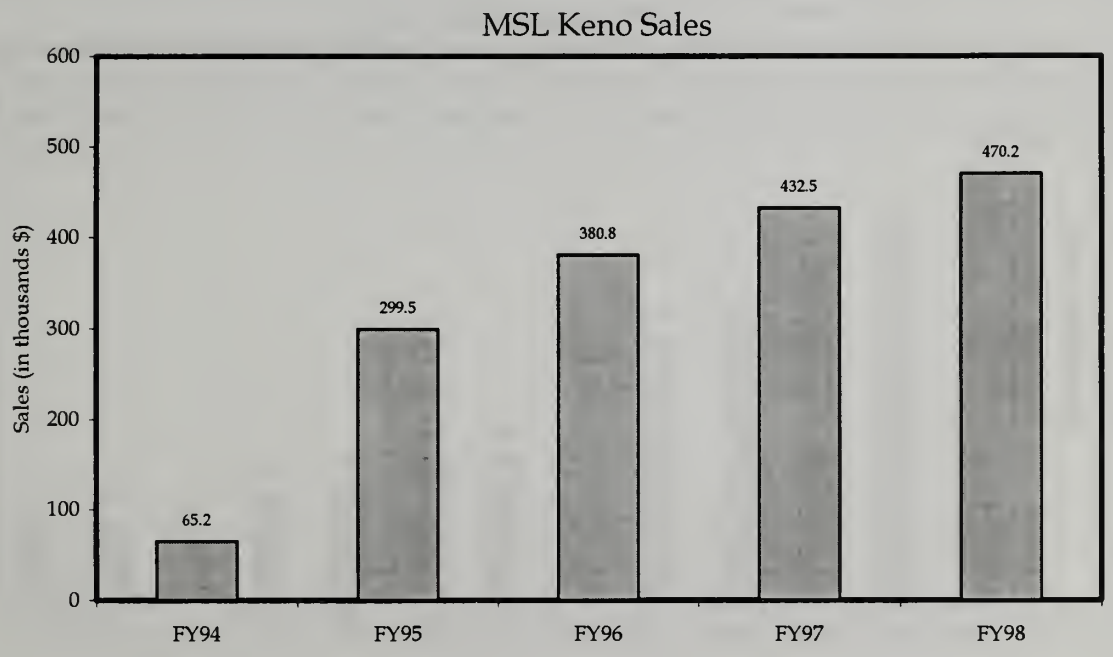
The above statistical analysis aptly identifies a pattern of substitution of spending among lottery products since the introduction of higher priced Instant games in 1992. Moreover, given the pattern of growth for the MSL since the introduction of casino gambling in Connecticut, it is plausible to assume a similar pattern will develop in Massachusetts when casino gaming is legalized.

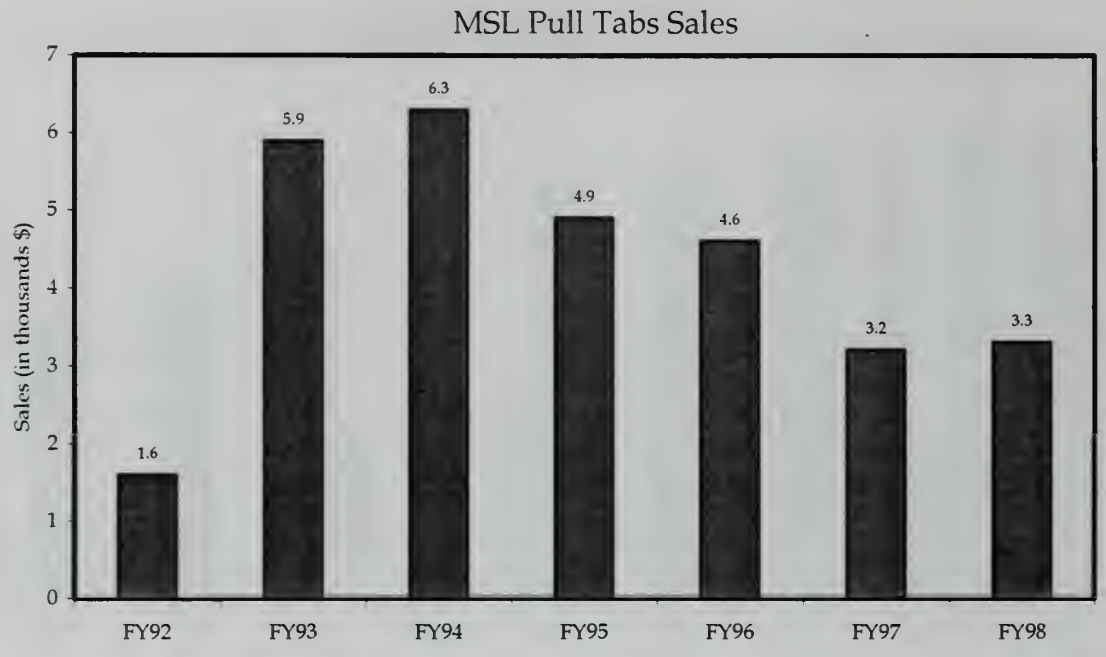
The following charts illustrate the sales history of the games within the MSL product portfolio over the last decade.

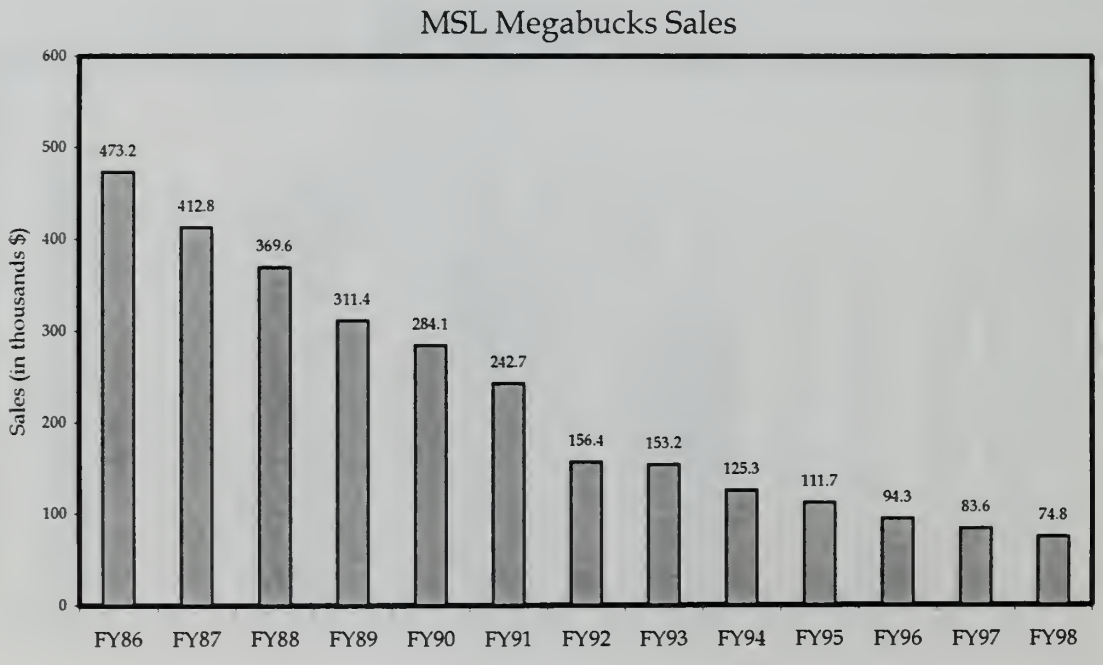
MSL Instant Game Sales
Sales (in thousands $)
2500
2000
1500
1000
500
0
244.6
388
470
613.5
671.6
746.7
895.8
1211.1
1591.7
1793.8
1973.5
2071.6
2085.3
FY86
FY87
FY88
FY89
FY90
FY91
FY92
FY93
FY94
FY95
FY96
FY97
FY98


MSL Numbers Game Sales
Sales (in thousands $)
600
500
400
300
200
100
0
371.5
393.5
412
427.3
466.7
462.3
444.6
437.5
431.5
414.5
382.3
378.9
385
FY86
FY87
FY88
FY89
FY90
FY91
FY92
FY93
FY94
FY95
FY96
FY97
FY98


MSL Mass Cash Sales
Sales (in thousands $)
120
100
80
60
40
20
0
31.1
98.1
93.5
90.3
81
76.3
67.4
59.8
FY91
FY92
FY93
FY94
FY95
FY96
FY97
FY98


MSL Keno Sales
Sales (in thousands $)
600
500
400
300
200
100
0
65.2
299.5
380.8
432.5
470.2
FY94
FY95
FY96
FY97
FY98


MSL Pull Tabs Sales
Sales (in thousands $)
0
1
2
3
4
5
6
7
1.6
5.9
6.3
4.9
4.6
3.2
3.3
FY92
FY93
FY94
FY95
FY96
FY97
FY98


MSL Megabucks Sales
Sales (in thousands $)
0
100
200
300
400
500
600
473.2
412.8
369.6
311.4
284.1
242.7
156.4
153.2
125.3
111.7
94.3
83.6
74.8
FY86
FY87
FY88
FY89
FY90
FY91
FY92
FY93
FY94
FY95
FY96
FY97
FY98

The above charts illustrate a range of sales patterns for the games in the MSL product portfolio. A far more accurate portrayal of lottery performance can be gleaned from an analysis of the annual rate of growth for each of the Massachusetts State Lottery's games. However, failure to account for the significant growth enjoyed by lottery products during their 'honeymoon' period (the difference between the first and second year following introduction of a lottery product) obfuscates a more accurate portrayal of MSL performance.

TABLE FOUR. MSL GAME AVERAGE ANNUAL GROWTH
(Fiscal Years 1986-1998 unless otherwise noted)

GAME	ANNUAL % INCREASE
Instant Games	18.8
Numbers Game	0.4
Mass Cash (91-98)	21.1
*Without First Year	2.5
Megabucks	-12.9
Mass Millions (92-98)	39.9
*Without First Year	2.5
Pull Tabs (92-98)	32.1
*Without First Year	-7.7
Keno (94-98)	82
*Without First Year	12.5
Total (Includes entire MSL product line)	8.7

The above table gives a realistic portrayal of the growth rates of the individual games in the MSL product portfolio. The flagship Instant game has enjoyed an average rate of annual sales growth of nearly 20 percent. However, the rest of the games in the Massachusetts State Lottery product line have not enjoyed the steady double-digit growth Instant game sales have been able to accrue. Megabucks has suffered an average decrease in sales of 12.9 percent over the last decade, making one question at what point this game will be removed from the product line. Additionally, by correcting for the effect of the 'honeymoon period' between the first and second years of a lottery product's life cycle, one can glean a more accurate picture of lottery performance. After accounting for this honeymoon effect, Mass Cash and Mass Millions average annual growth is only 2.5 percent. Pull Tabs actually suffers from declining sales averaging 7.7 percent when this adjustment is made. Only Keno still enjoys significant average annual growth (12.5 %) after this honeymoon period is accounted for.

This finding has strident implications on lottery performance. If the MSL is indeed bent on maximizing revenue, a pattern of sales growth must be nurtured. By introducing new games to the product portfolio, one may perceive a positive short term impact on lottery performance. However, as most lottery products reach maturity (approximately 30-36 months) a pattern of decreasing sales becomes the predominant model of lottery performance. Without profound structural adjustments (introduction of new, higher priced games, e.g.), the days of double-digit growth for the Massachusetts State Lottery may be over. In fact, the MSL has estimated total sales growth of 5.5 percent for fiscal year 1999, a decrease from the 8.7 percent average annual growth the lottery has enjoyed over the last decade. The real threat to the future of the Massachusetts State Lottery will not come from the introduction of casino gaming, but failure to make structural adjustments to the product portfolio in a timely fashion.

3.20 REGRESSION ANALYSIS

Another statistical technique utilized in this study to analyze Massachusetts State Lottery performance is regression analysis. If y is the variable to be plotted on the vertical axis, and x is the variable to be plotted on the horizontal axis, the equation to be specified is

$$y = a + bx$$

where y is the dependent variable, a is the intercept of the series (the predicted value for y when x is 0), and b is the slope (the change in y when x changes by one unit). Therefore, specifying equations for each of the individual games in the Massachusetts State Lottery product portfolio can be instrumental in surmising the future rate of growth. A statistical analysis of the post +$1 Instant game series estimated the following equations[9]

INSTANT	Yt = 97562.6 + 1189.26*t
NUMBERS	Yt = 37160.2 - 81.6525*t
MASS CASH	Yt = 8340.52 - 45.4685*t
KENO	Yt = -1976.09 + 614.966*t
PULL TAB	Yt = 489.907 - 2.61251*t
MEGABUCKS	Yt = 12991.3 - 98.3080*t
MASS MILLIONS	Yt = 10542.9 - 50.5962*t
TOTAL SALES	Yt = 160832 + 1657.22*t

The most important term in the above equation is the slope b. This statistic can be interpreted as for every change in time (in the case of the post +$1 Instant game time series, a month) the slope is the expected amount of change from month to month.[10] Thus, the above specified regression equations argue that Instant Game sales will increase by 1.19 million dollars monthly, or 14.28 million dollars annually. Conversely, the above equations indicate that the MSL Numbers, Mass Cash, Pull Tabs, Megabucks, and Mass Millions game will suffer from declining sales in the future.

The statistical findings extracted from the above linear regression models have significant implications on the future of the Massachusetts State Lottery. The above analysis indicates a majority of products within the MSL game portfolio may be facing a pattern of decaying sales in the future. Only Instant Games and Keno appear to have any future vitality with regard to sales growth. In terms of the impact of casino gambling on Massachusetts State Lottery performance, it is unfair to attribute declining sales to the introduction of casino activity. As the previous discussion of a broad cross-section of states indicates, casinos and lotteries can coexist. The real key to improving MSL sales performance should not be rooted in a protectionist strategy seeking to prevent casino gaming from being introduced in Massachusetts. Instead, public policy makers should reconsider the vitality of a majority of lottery products that are currently immersed in a downward sales spiral.

[9] Yt refers to the Tth observation of a time series, while *t refers to an error term associated with Yt.
[10] Note the lottery sales statistics utilized in this study were in thousands.

3.30 ARIMA MODELING

An early effort to isolate the effect of casino gambling on state lottery sales was by Richard McGowan of Boston College. Professor McGowan utilized ARIMA modeling to ascertain the effect the intervention of casino legalization had on lottery sales. McGowan concluded that the introduction of casino gambling had no significant negative effect on lottery sales in Connecticut either in the short run or in the long run.[11] This study attempts to build on the earlier findings of the McGowan study to ascertain the effect the introduction of casino gambling has on state lotteries.

In order to forecast the future sales performance of the Massachusetts State Lottery, this study utilizes one particular class of time series models, Auto Regressive Integrated Moving Average (ARIMA) models. This statistical technique is especially useful when long time-series (50+ points) are available. Given the monthly sales figures obtained for the Massachusetts State Lottery, an ARIMA model building strategy utilized to isolate the correct stochastic model for the flagship Instant game allows for more accurate forecasts of lottery revenue. Given the centrality of lottery generated profits to public finance in Massachusetts, The basic equation to be estimated for an ARIMA model is

$$Y_t = a + bX_t + e_t$$

where Y_t is the endogenous variable, X_t is the exogenous variable, e_t is the random disturbance term, and a and b are unknown parameters, and the subscript t indicates that X_t and Y_t are a series of observations throughout time. ARIMA modeling incorporates the five assumptions of classical linear regression (Pindyck and Rubinfeld 1976, pp. 16-17). Additionally, there is an assumption that the error term is normally distributed.

The iterative ARIMA modeling strategy consists of several related steps. The process begins with the identification of a tentative ARIMA model for the data series. Autocorrelation functions are examined to see if it is necessary to difference or transform the series. The parameters of the tenative model are then estimated. All parameter estimates must be statistically significant and lie within the bounds of stationary-invertibility. Failure to meet both of these criteria requires the analyst to identify a new model for the series. If the model meets these criteria, it is then diagnosed. The residuals of the series are analyzed to determine if they are 'white noise'. This process is repeated until an adequate, parsimonious model has been generated for the series.

A separate ARIMA (p,d,q) model will be estimated for each game in the lottery product line.[12] I argue that the disparate theoretical relationship between autoregressive and moving average models permits isolation of the effects different games on lottery performance. Autoregressive models can be expressed as the infinite sum of exponentially weighted past random shocks (McCleary and Hay 1980, p. 57). A first order (1,d,q) autoregressive model is estimated via the equation

[11] For a explanation and discussion of the utilization of ARIMA (auto-regressive integrated moving average) models, see McDowall, David, et al, (1980) and McCain, Leslie and McCleary, Richard, (1979), . 233-293

[12] where p = the order of autoregression, d = the order of differencing, and q = the order of moving average.

$$y_t = o_1 y_{t-1} + a_t$$

where o is the autoregressive parameter to be estimated
After identifying a tentative ARIMA model, parameter *b* can be estimated for each of the individual games offered by the lottery. On the other hand moving average models can be expressed as an infinite series of exponentially weighted past observations. A random shock enters the system and persists for no more than q observations before disappearing entirely (McCleary and Hay 1980, p. 61). A first order (p,d,1) moving average model is estimated via the equation

$$y_t = a_t - O_1 a_{t-1}$$

where O is the moving average parameter to be estimated.[13] First order (1,d,q) or (p,d,1) models adequately represent about eighty percent of all time series in the social sciences (Vandaele 1983). Therefore, it is reasonable to expect the vast preponderance of series being examined will fall within this categorization.

The ARIMA model building strategy identified a seasonality component to the Instant game time series.[14] Many time series exhibit systematic periodic shifts as a pattern of behavior repeats itself (McCain and McCleary 1979, 253). Seasonality of data is handled by incorporating a season structure into the stochastic element of an ARIMA model, and is specified by upper case (P, D, Q) structural parameters. The model building strategy identified a (0,0,1) (0,0,1) differenced model for the Instant game series.[15] Utilizing this ARIMA model for forecasting series resulted in an annual average growth of 15.7 million dollars for the next five years. Note that this estimate is consistent with the current pattern of Instant game sales growth, which grew by less than 14 million dollars from fiscal year 1997 to fiscal year 1998.

While it may be intrinsically interesting to specify an ARIMA model for total Massachusetts State Lottery sales, this study argues a disaggregated approach to lottery sales forecast provides a more accurate picture of future MSL performance. Moreover given the very strong positive association between Instant game and total MSL sales, a focus on the future of Instant scratch-off ticket sales provides a useful window through which to view the future sales performance of the Massachusetts State Lottery.

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[13] For a discussion of the role of stationarity and differencing in ARIMA modeling, see Vandaele (1983), chapter 2.

[14] Given the centrality of Instant game sales to MSL performance, as evidenced by the previously discussed correlation matrices and regression analysis, the study will focus solely on the model building strategy for the post +$1 Instant game time series. This truncated discussion and presentation of diagnostic tools (autocorrelation and partial autocorrelation correlograms, i.e.) in an appendix to this study is intended to present as parsimonious a model as possible for the lay reader. The complete set of ARIMA models for the full range of MSL games, and the diagnostic tools utilized within the model building process run over 100 pages and would tax the patience of even the most ardent reader. These materials are available upon request from the Center for Policy Analysis.

[15] The Instant Game Series had to be lagged to minimize the stochastic element in the series.

3.40 THE FUTURE OF GAMBLING POLICY IN MASSACHUSETTS

Given a pattern of significant sales growth since casino legalization in Connecticut, and the central role Massachusetts State Lottery revenue plays within public finance, it is rational for policymakers to be protective of the MSL 'cash cow'. Since the MSL provides the majority of Direct Local Aid for cities and towns throughout the Commonwealth, state legislators with an ever-present eye on reelection, cast a wary eye towards any gambling policy proposals that could conceivably curtail the sustained popularity of the Massachusetts State Lottery. However, MSL sales since the introduction of casinos in Connecticut indicate Foxwoods and the Mohegan Sun have not had the negative fiscal impact on lottery sales envisioned by casino opponents. This finding refutes the arguments of casino opponents rooted in an incorrect appraisal of the substitutability issue of gambling activity. It may be just as implausible to argue Massachusetts State Lottery sales have increased because of the introduction of casino gaming in Connecticut, as it is to assert Connecticut State Lottery Sales have increased because of casino legalization. A recent study of gambling activity in Connecticut found the main impetus to lottery growth was the introduction of higher priced instant games—games costing $2 or more—in fiscal years 1995 and 1996 (WEFA 1996, 3). This suggests the key to lottery performance may be rooted in assessment and modification of the structural characteristics of lottery products, not a close-minded perspective which fails to recognize casino gaming has had a positive fiscal impact in each and every state in which commercial gaming has been introduced.

Irrespective of the evidence indicating lotteries and casinos are coexisting and fiscally flourishing in a number of locales nationwide, a misplaced focus on lottery sales does aids in enlightening state policymakers to the fact lottery sales are not automatically adversely effected by the introduction of casino gaming activity. State lottery sales figures are but one measure of the relative success of these state enterprises. However, a concurrent issue within the casino legalization debate centers on the question of whether gambling generated revenue destined for state coffers increases after the introduction of casinos. This study argues an appraisal of the future impact of casino gaming on state public finance is much more accurately portrayed by an assessment of gambling generated revenues, not sales. The evidence overwhelmingly suggests the Massachusetts State Lottery will continue to prosper in the aftermath of casino legalization.

While an analysis of lottery sales patterns may reveal interesting insights into lottery performance, for state legislators the real fiscal issue is whether gambling generated revenue will increase in the aftermath of casino legalization. Given the Massachusetts State Lottery's essential role within public finance, casino opponents argue the introduction of new forms of gambling activity will have a deleterious effect on lottery sales, and therefore on the MSL's ability to deliver Direct Local Aid to cities and towns throughout the Commonwealth. However, a detailed examination of financial records of the states that have both casino gambling and state lotteries indicates a pattern of revenue growth since casino legalization.

This study finds in every state in which casino gaming has been introduced, state revenues generated from gambling activity have significantly increased. From a fiscal

perspective, the bottom line for legislators is gambling generated revenues[16] accruing to the state will increase after the introduction of casino gaming. This study replicates an earlier industry study focusing on seven states with pre-existing lotteries having commercial (non-Indian) gaming. That study found that gambling generated revenues increased in all seven states (Harrahs 1996). The addition of several years' data and several other casino legalizing states has highlighted the fact state finance has been enhanced by the addition of casino gambling to a state's gambling product portfolio.

One of the primary rationales underlying the current debate over casino legalization in Massachusetts rests in an attempt to recapture millions of dollars of Bay State money that is being spent in adjacent state's gaming facilities. From a regional perspective, the state of Connecticut provides the vast bulk of competition for the Massachusetts gambling dollar. An evaluation of Connecticut's gambling generated revenues since casino legalization isolates several interesting findings that need to be contemplated by state decision makers pondering the legalization of casinos in Massachusetts. An especially noteworthy trend is a pattern of significant growth for lottery generated revenues in Connecticut since the inception of casino gaming.

While a pattern of growth for gambling related revenues exists within all states for this previous study, a closer examination of the evidence indicates the majority of state lotteries have continued a pattern of revenue growth in the aftermath of casino legalization. Especially noteworthy within this category is the State of Connecticut. During fiscal year 1998 the Connecticut State Lottery contributed over $264 million dollars to the General Reserve Fund (Department of Special Revenue 1999). Once again, if Massachusetts lawmakers are bent of attaining the fiscal success enjoyed by their Connecticut counterparts, the evidence reveals lottery generated revenues can increase in the aftermath of casino legalization.

Given the fact that many casino operations aspire to the type of fiscal success Foxwoods has enjoyed, these findings have strident implications for states considering casino legalization. The fact lottery sales growth actually *increased* in the aftermath of casino legalization is especially noteworthy. It is apparent from the Connecticut experience that state lottery sales can actually flourish and coexist with casino expansion.

The future of Massachusetts state gambling policy is murky at best. To paraphrase a euphemism from one of the state legislature's most astute observers of gambling, Representative Dan Bosley, Massachusetts gambling policy is being 'put in a box'. While the Joint Government Regulations Committee saw fit to question the methodology employed by the Center for Policy Analysis in its Patron Origination Analysis of Foxwoods and the Mohegan Sun casinos in Connecticut, no one has questioned the empirical reality underlying this study-a number of Massachusetts residents travel to Connecticut to wager at these two Native American casinos. The existence of video lottery terminals at the state of Rhode Island's two pari-mutual facilities, Lincoln Park and the Newport Jai-Alai fronton, provide a convenient gambling opportunity for Bay State residents. The state of New Hampshire is considering placing 3,750 slot machines at the Granite State's three racetracks. While on April 2, 1999, the New Hampshire House of Representatives summarily killed this gambling proposal by a 300-14 margin, the failure

[16] Gambling generated revenues refers to the total fiscal contribution made by state lotteries and commercial casinos to state finance.

of Granite State legislatures to find a funding solution for the state educational system may cause legislators to revisit this issue in the very near future. Additionally, expansion of Indian gaming in New York is a distinct possibility in the near future. Massachusetts could soon find itself surrounded by states providing enhanced opportunities for Bay State residents to gamble.

Unfortunately, gambling policy, like much of public policy, is made in a reactive fashion. Instead of Massachusetts legislators taking some initiative in an attempt to recapture the gambling dollars which are leaving the state, it appears Bay State lawmakers, in attempting to protect the Massachusetts State Lottery 'cash cow', have failed to recognize the fiscal largesse which nine other states have actively pursued. While it may be rationale for state legislators, bent on maximizing Direct Local Aid for their constituents, to be protective of the MSL, this study has demonstrated a pattern of decaying sales for a number of games in the Massachusetts State Lottery product portfolio. The pattern of double digit annual growth for the MSL appears to be over. State legislators, with their unquenchable thirst for more and more revenue, need to reassess their allegiance to the uncertain future of the Massachusetts State Lottery.

4.00 CONCLUSION

This study has reached the following conclusions:

- The introduction of casinos has a positive fiscal impact on state finance. Gambling generated revenue has increased in each state that hosts commercial casinos.[17]

- The Massachusetts State Lottery's (MSL) pattern of sales growth has increased since the introduction of Native-American casinos in neighboring Connecticut. The MSL's annual percentage change in total sales, along with the total net revenue dollars going towards Bay State coffers has increased since the opening of the Foxwoods gaming facility in 1992.

- Connecticut State Lottery sales and revenues have increased since the introduction of casino gaming in Connecticut. The Connecticut State Lottery contributed over $264 million to state coffers in 1998, more than the amount given by casinos in the state. It is reasonable to assume a similar pattern of lottery growth will occur when casinos are introduced in Massachusetts.

- While lottery supporters decry casinos as a threat to lottery 'success', state lottery sales have increased in several states after the introduction of casinos. Colorado, Illinois and Iowa have all enjoyed lottery sales increases since the introduction of commercial casinos.

[17] Commercial casino refers to non Native-American casinos. The terms Native-American and Indian casinos are used interchangeably throughout this study.

- There is little substitution of spending between casinos and lotteries. An analysis of lottery sales since the introduction of casino gaming reveals the markets for these two forms of gambling activity are essentially different.

- Instant scratch-off games, the flagship product of the Massachusetts State Lottery, will continue to grow after the introduction of casino gaming. This pattern is consistent with that achieved in Connecticut, Iowa and Illinois. This finding suggests that the introduction of casinos into Massachusetts will have a negligible effect on instant game sales for the MSL.

- A number of games in the Massachusetts State Lottery product portfolio are currently suffering from a sustained pattern of decaying sales. In particular, the Megabucks game has averaged an annual sales decrease of 12.9 percent over the last decade. MSL officials should consider eliminating one or more games from its product portfolio.

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APPENDIX B

PRIZE STRUCTURES FOR MSL PRODUCT LINE

INSTANT GAME PRIZE STRUCTURE

PRICE	NAME	TOP PRIZE	WINNERS PER GAME	PROBABILITY	OVERALL ODDS OF WINNING
$5	200,000 Jackpot	200,000	50	1: 604,800	1: 4.809
$3	High Stakes	50,000	60	1: 504,000	1: 4.77
$2	Break the Bank	20,000	50	1: 1,008,000	1: 4.76
$1	Quicksilver	1,000	1080	1: 56,000	1:4.86

THE BIG GAME PRIZE STRUCTURE

MATCH	WIN	PROBABILITY
5 plus big money ball	Jackpot	1: 76,275,360
5	150,000	1: 2,179,296
4 plus big money ball	5,000	1: 339,001.6
4	150	1: 9,685.6
3 plus big money ball	100	1: 7,704.6
3	5	1: 220.1
2 plus big money ball	5	1: 537.5
1 plus big money ball	2	1: 102.4
big money ball	1	1: 62.4

THE NUMBERS GAME ODDS OF WINNING

# DIGITS BET	EXACT	ANY ORDER			
		NO DUPLICATES Ex: 1234	2 THE SAME Ex: 1224	2 PAIR Ex: 2244	3 THE SAME Ex: 3334
3	1: 1,000	1: 166.7	1: 333.3	N/A	1:1,000
4	1: 10,000	1: 416.7	1: 833.3	1: 1667.7	1: 2,500

MASS CASH PRIZE STRUCTURE

MATCH	WIN	PROBABILITY
All Five	100,000	1: 324,632
4 of 5	250	1: 2,164.21
3 of 5	10	1: 74.63

KENO PRIZE STRUCTURE

MATCH	PRIZE	MATCH	PRIZE
12 of 12	1,000,000	8 of 8	15,000
11 of 12	25,000	7 of 8	1,000
10 of 12	2,500	6 of 8	50
9 of 12	1,000	5 of 8	10
8 of 12	150	4 of 8	2
7 of 12	25		
6 of 12	5	7 of 7	5,000
0 of 12	4	6 of 7	100
		5 of 7	20
11 of 11	5,000,000	4 of 7	3
10 of 11	15,000	3 of 7	1
9 of 11	1,500		
8 of 11	250	6 of 6	1,600
7 of 11	50	5 of 6	50
6 of 11	10	4 of 6	7
5 of 11	1	3 of 6	1
0 of 11	2		
		5 of 5	450
10 of 10	100,000	4 of 5	20
9 of 10	10,000	3 of 5	2
8 of 10	500		
7 of 10	80	4 of 4	100
6 of 10	20	3 of 4	4
5 of 10	2	2 of 4	1
0 of 10	2		
		3 of 3	25
8 of 8	15,000	2 of 3	2.50
7 of 8	1,000		
6 of 8	50	2 of 2	5
5 of 8	10	1 of 2	1
4 of 8	2		
		1 of 1	2.50

KENO OVERALL ODDS OF WINNING

NUMBER OF SPOTS PLAYED	ODDS OF WINNING	NUMBER OF SPOTS PLAYED	ODDS OF WINNING
12	1: 15.73	6	1: 6.19
11	1: 7.63	5	1: 10.34
10	1: 9.05	4	1: 3.86
9	1: 6.53	3	1: 6.55
8	1: 9.77	2	1: 2.27
7	1: 4.23	1	1: 4.00

MEGABUCKS PRIZE STRUCTURE

MATCH	WIN	PROBABILITY
All six numbers	Jackpot	1: 5,245,786
5 of 6	1,500	1: 24,286.05
4 of 6	75	1: 555.11
3 of 6	Free Bet	1: 36.74

MASS MILLIONS PRIZE STRUCTURE

MATCH	WIN	PROBABILITY
All six numbers	Jackpot	1: 13,983,816
5 of 6 plus bonus number	50,000	1: 2,330,636
5 of 6	3,000	1: 55,491.3
4 of 6	100	1: 1,032.4
3 of 6	Free Bet	1: 55.7

APPENDIX C

REGRESSION ANALYSIS FOR TOTAL MSL SALES 1989-1998 (WITH CORRELATION MATRICES)

TOTAL CORRELATION COEFFICIENT MATRIX, MASSACHUSETTS STATE LOTTERY, 1989-1998

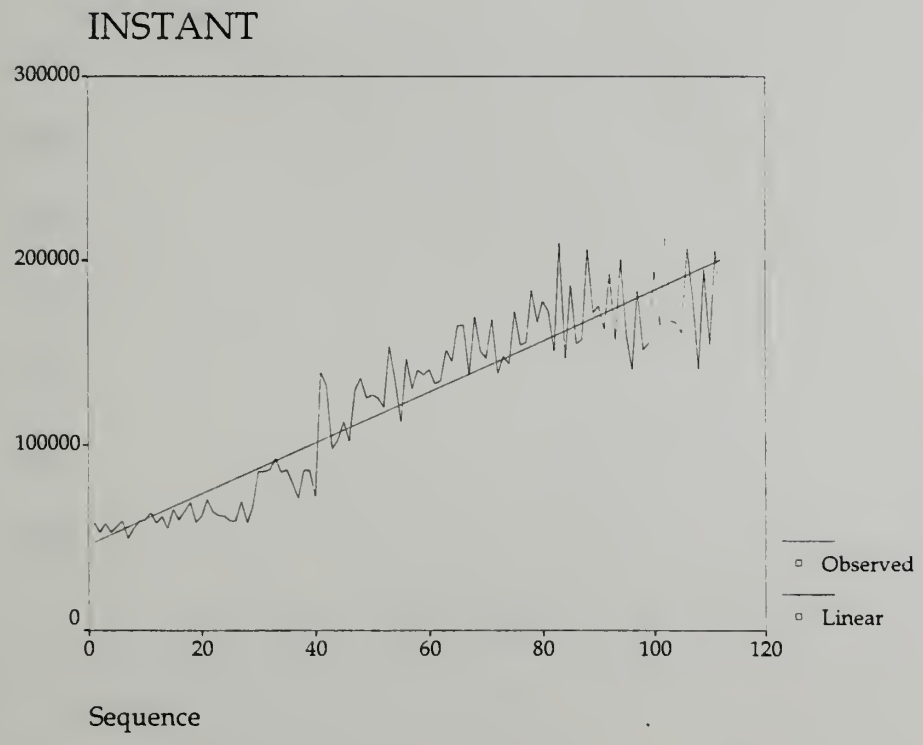
	INST	BIGA	NUMB	MCAS	KENO	CHAR	BEAN	PTAB	MEGA	MMIL	TSAL
INST		.04	-.44**	-.54**	.80**	-.14	-.32*	.02	-.81**	-.12	.98**
BIGA	.04		.09	-.16	.17	-.27	-.26	.24	.04	.24	.17
NUMB	-.44**	.09		.61**	-.16	.40**	.30*	.20	.62**	.27**	-.34**
MCAS	-.54**	-.16	.61**		-.58**	.52**	.35*	.32**	.65**	.36**	-.50**
KENO	.80**	.17	-.16	-.58**		-.23	-.38**	-.61**	-.71**	-.19	.81**
CHAR	-.14	-.27	.40**	.52**	-.23		.61**	.25	.47**	.12	-.07
BEAN	-.32*	-.26	.30*	.35*	-.38**	.61**		.16	.38**	.03	-.27
PTAB	.02	.24	.20	.32**	-.61**	.25	.16		.29**	.26*	-.03
MEGA	-.81**	.04	.62**	.65**	-.71**	.47**	.38**	.29**		.27**	-.76**
MMIL	-.12	.24	.27**	.36**	-.19	.12	.03	.26*	.27**		-.01
TSAL	.98**	.17	-.34**	-.50**	.81**	-.07	-.27	-.03	-.76**	-.01	

*. Correlation is significant at the 0.05 level

**. Correlation is significant at the 0.01 level

INST = Instant
BIGA = Big Game
NUMB = Numbers
MCAS = Mass Cash
KENO = Keno
CHAR = Charity
BEAN = Beano
PTAB = Pull Tabs
MEGA = Megabucks
MMIL = Mass Millions
TSAL = Total Sales

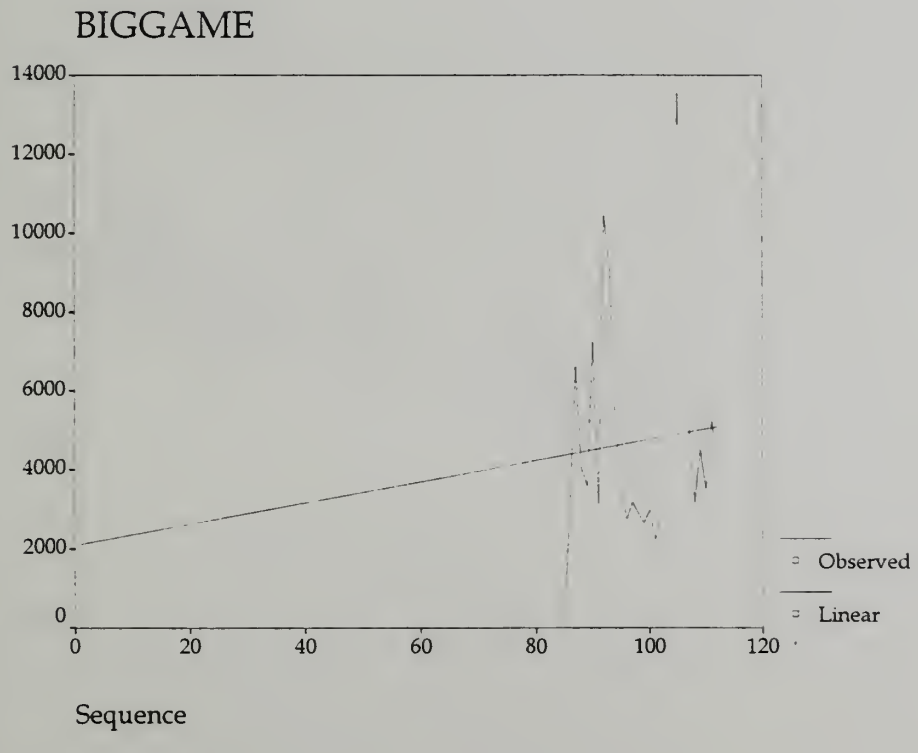
```
Dependent variable.. INSTANT          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .92625
R Square             .85794
Adjusted R Square    .85665
Standard Error  18316.26646

           Analysis of Variance:

                DF   Sum of Squares      Mean Square

Regression       1   222865657176.3   222865657176.3
Residuals      110    36903417879.4      335485617.1

F =     664.30764       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time            1379.756586   53.532540    .926249    25.774  .0000
(Constant)     45920.699324 3484.758685               13.178  .0000

The following new variables are being created:

  Name        Label

  FIT_1       Fit for INSTANT from CURVEFIT, MOD_1 LINEAR
  ERR_1       Error for INSTANT from CURVEFIT, MOD_1 LINEAR
```



Curve Fit

```
MODEL:  MOD_2.
```

```
Dependent variable.. BIGGAME          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .07892
R Square             .00623
Adjusted R Square   -.03199
Standard Error   2835.44866

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1        1310102.8        1310102.8
Residuals      26      209033997.1        8039769.1

F =        .16295       Signif F =  .6898

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time              26.778325   66.336494    .078920       .404  .6898
(Constant)      2082.263547 6556.079705                   .318  .7533

The following new variables are being created:

  Name        Label

  FIT_2       Fit for BIGGAME from CURVEFIT, MOD_2 LINEAR
  ERR_2       Error for BIGGAME from CURVEFIT, MOD_2 LINEAR
```



Curve Fit

```
MODEL:  MOD_3.
```

Dependent variable.. NUMBERS Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R .56227
R Square .31614
Adjusted R Square .30993
Standard Error 3974.13642

Analysis of Variance:

	DF	Sum of Squares	Mean Square
Regression	1	803147806.1	803147806.1
Residuals	110	1737313633.0	15793760.3

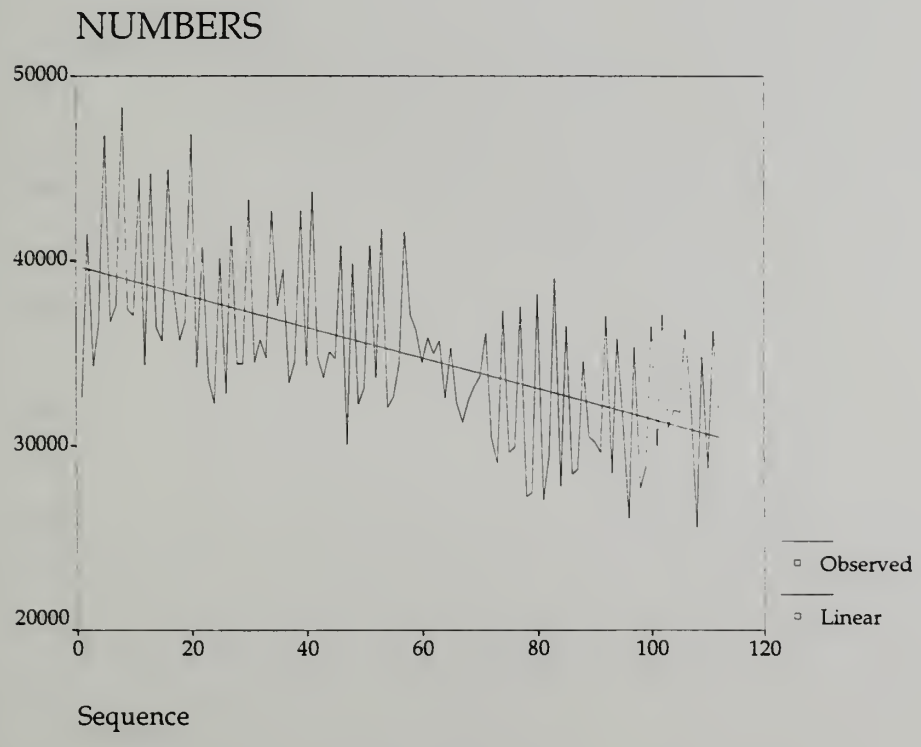
F = 50.85222 Signif F = .0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
Time	-82.828279	11.615119	-.562265	-7.131	.0000
(Constant)	39716.637066	756.098763		52.528	.0000

The following new variables are being created:

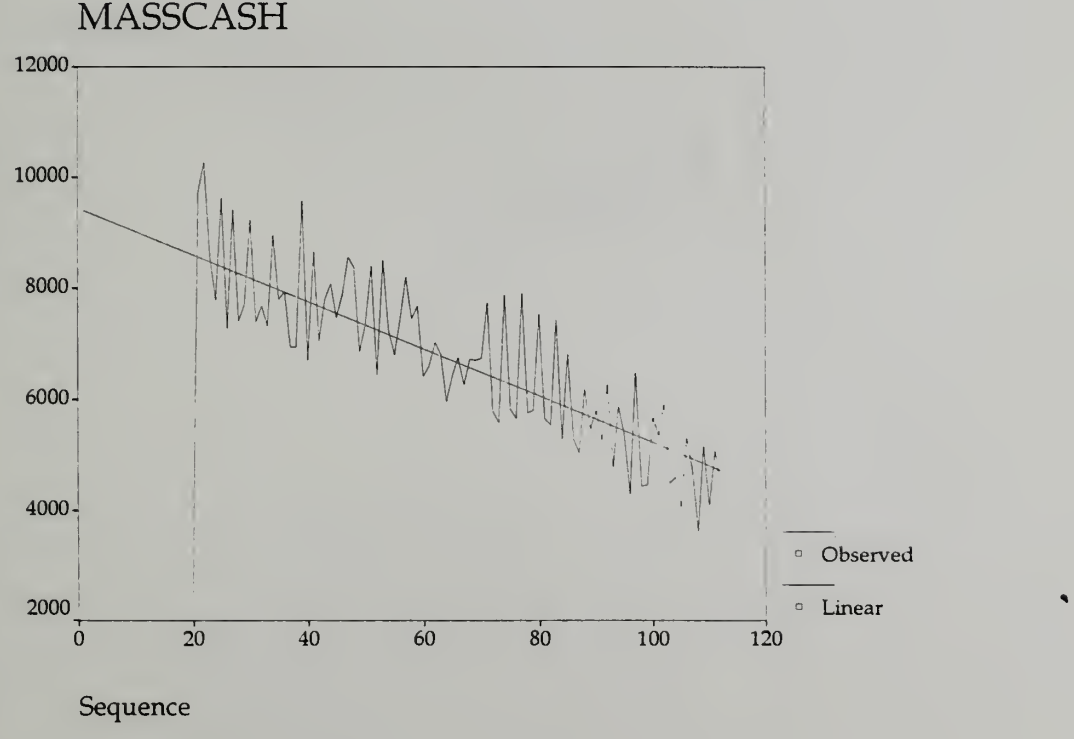
Name	Label
FIT_3	Fit for NUMBERS from CURVEFIT, MOD_3 LINEAR
ERR_3	Error for NUMBERS from CURVEFIT, MOD_3 LINEAR



Curve Fit

MODEL: MOD_4.

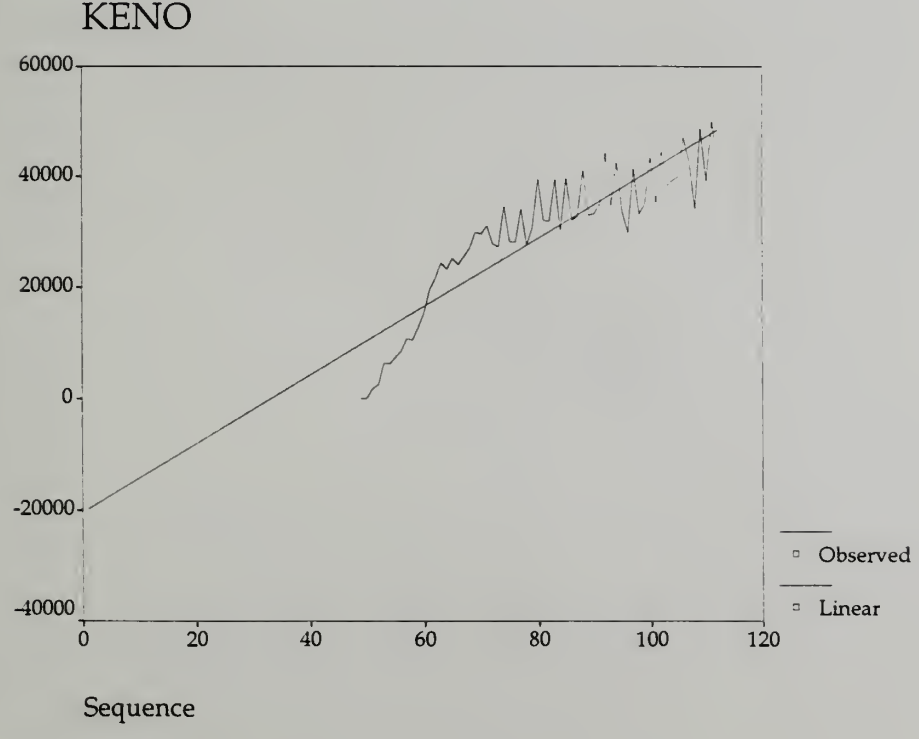
```
Dependent variable.. MASSCASH          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .74937
R Square             .56156
Adjusted R Square    .55674
Standard Error   1011.70576

            Analysis of Variance:

                DF    Sum of Squares      Mean Square

Regression       1      119299896.0      119299896.0
Residuals       91       93142918.5        1023548.6

F =     116.55519       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B         SE B       Beta         T  Sig T

Time              -42.190176     3.907919   -.749375   -10.796  .0000
(Constant)       9436.626909   278.442072               33.891  .0000

The following new variables are being created:

  Name        Label

  FIT_4       Fit for MASSCASH from CURVEFIT, MOD_4 LINEAR
  ERR_4       Error for MASSCASH from CURVEFIT, MOD_4 LINEAR
```



Curve Fit

```
MODEL:  MOD_5.
```

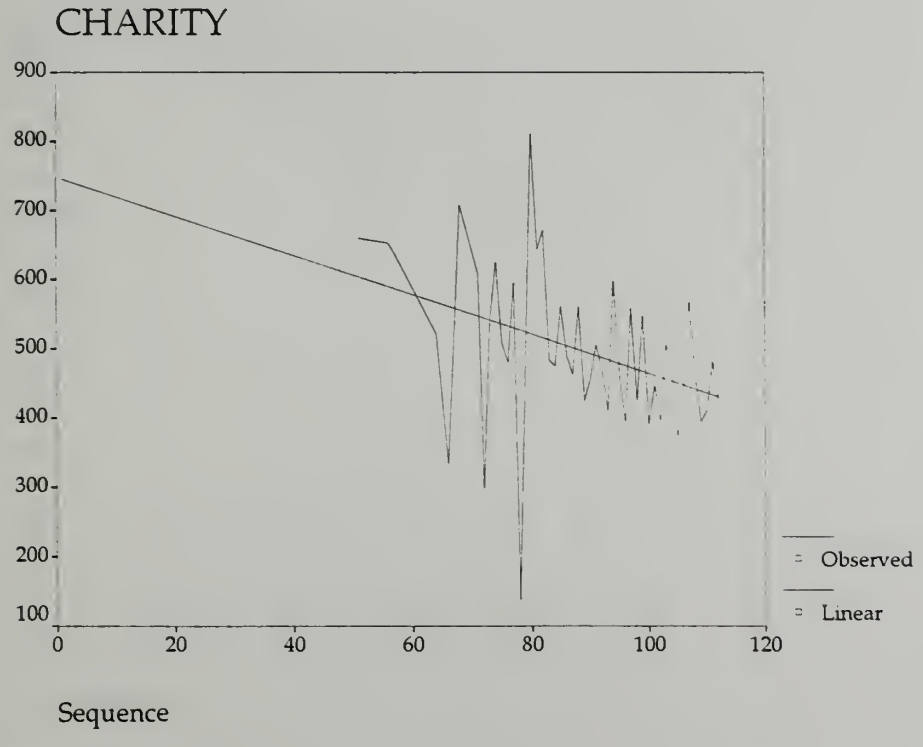
```
Dependent variable.. KENO              Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .89587
R Square             .80259
Adjusted R Square    .79941
Standard Error   5724.24065

            Analysis of Variance:

                DF   Sum of Squares      Mean Square

Regression       1     8259520135.3     8259520135.3
Residuals       62     2031549726.5       32766931.1

F =     252.06877       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time              614.965980   38.733930    .895874     15.877  .0000
(Constant)     -20425.073878 3199.127201                -6.385  .0000

The following new variables are being created:

  Name        Label

  FIT_5       Fit for KENO from CURVEFIT, MOD_5 LINEAR
  ERR_5       Error for KENO from CURVEFIT, MOD_5 LINEAR
```



Curve Fit

```
MODEL:  MOD_6.
```

```
Dependent variable.. CHARITY          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .38325
R Square             .14688
Adjusted R Square    .12834
Standard Error    108.12738

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1         92596.07        92596.066
Residuals      46        537810.41        11691.531

F =       7.91993       Signif F =  .0072

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time                -2.838627    1.008667   -.383253     -2.814  .0072
(Constant)         747.779703   89.731078                 8.334  .0000

The following new variables are being created:

  Name        Label

  FIT_6       Fit for CHARITY from CURVEFIT, MOD_6 LINEAR
  ERR_6       Error for CHARITY from CURVEFIT, MOD_6 LINEAR
```



Curve Fit

```
MODEL:  MOD_7.
```

Dependent variable.. BEANO Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R	.34023
R Square	.11576
Adjusted R Square	.09654
Standard Error	79.95683

Analysis of Variance:

	DF	Sum of Squares	Mean Square
Regression	1	38499.48	38499.483
Residuals	46	294082.33	6393.094

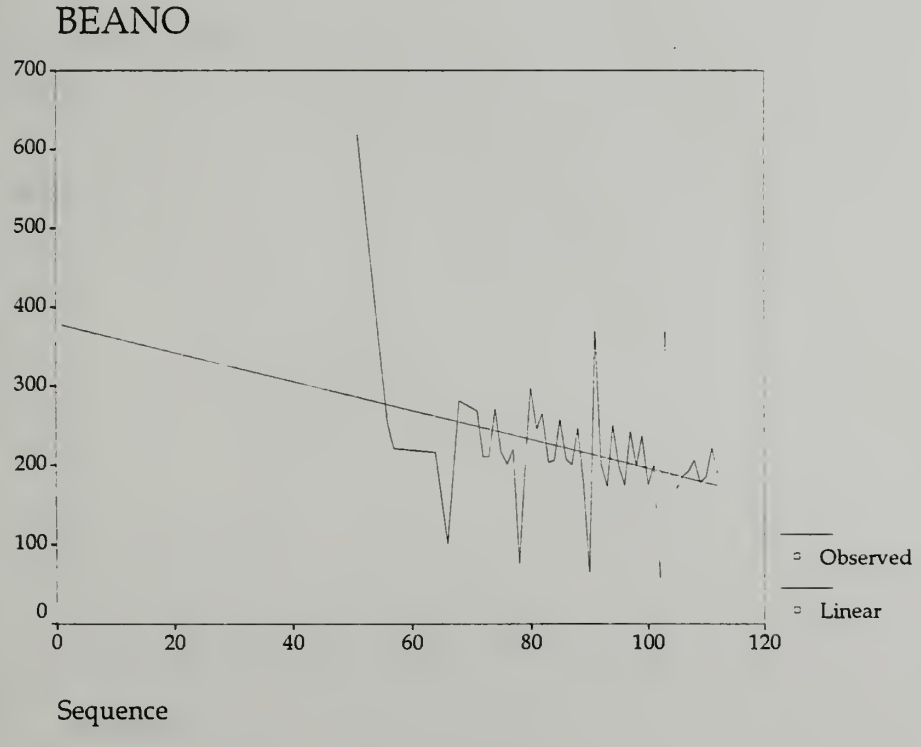
F = 6.02204 Signif F = .0180

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
Time	-1.830373	.745878	-.340234	-2.454	.0180
(Constant)	378.785758	66.353334		5.709	.0000

The following new variables are being created:

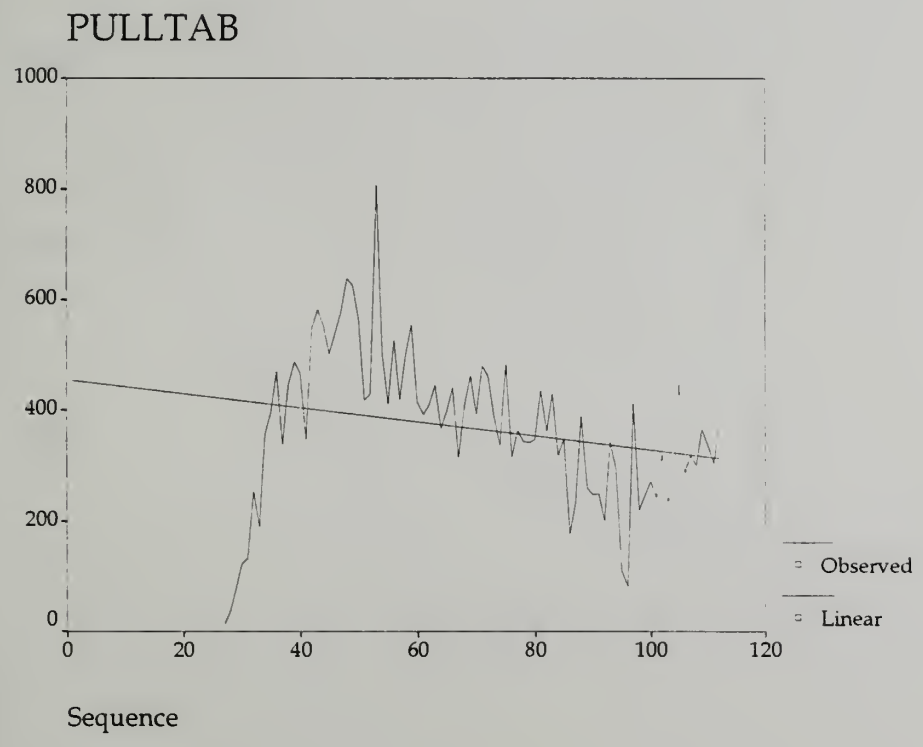
Name	Label
FIT_7	Fit for BEANO from CURVEFIT, MOD_7 LINEAR
ERR_7	Error for BEANO from CURVEFIT, MOD_7 LINEAR



Curve Fit

MODEL: MOD_8.

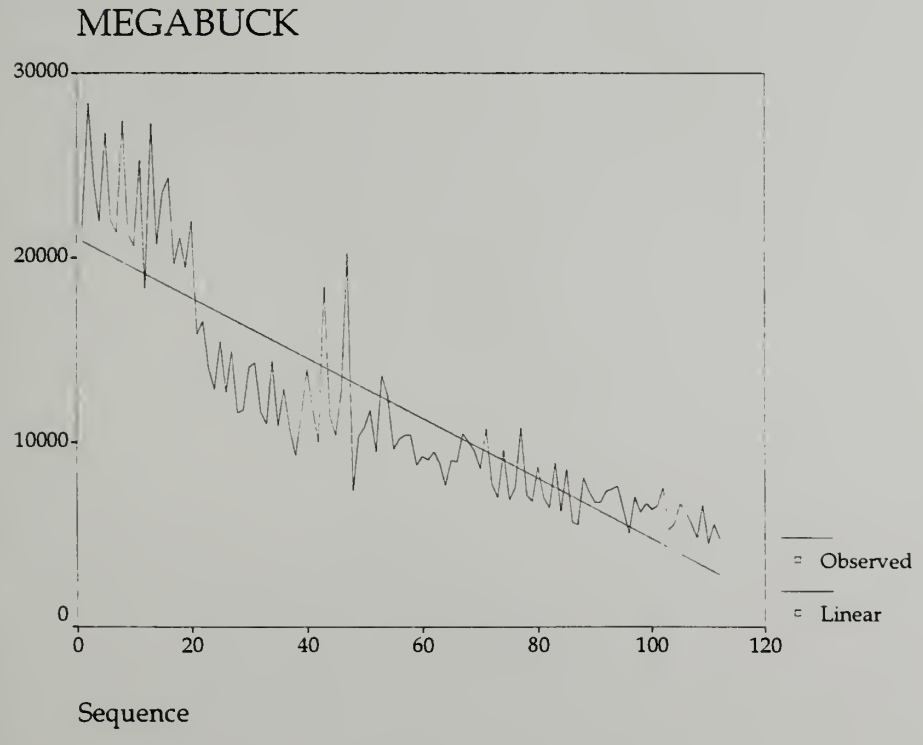
```
Dependent variable.. PULLTAB          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .22578
R Square             .05098
Adjusted R Square    .03968
Standard Error    137.90598

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1          85813.2        85813.177
Residuals      84        1597516.9        19018.059

F =       4.51219       Signif F =  .0366

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time              -1.272475     .599039   -.225784     -2.124  .0366
(Constant)       455.064928   44.209352                10.293  .0000

The following new variables are being created:

  Name        Label

  FIT_8       Fit for PULLTAB from CURVEFIT, MOD_8 LINEAR
  ERR_8       Error for PULLTAB from CURVEFIT, MOD_8 LINEAR
```



Curve Fit

```
MODEL:  MOD_9.
```

```
Dependent variable.. MEGABUCK          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .87504
R Square             .76570
Adjusted R Square    .76357
Standard Error   2939.01637

            Analysis of Variance:

                 DF   Sum of Squares      Mean Square

Regression        1     3105113274.1     3105113274.1
Residuals       110      950159893.3        8637817.2

F =     359.47893       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta         T  Sig T

Time            -162.861948    8.589797   -.875042   -18.960  .0000
(Constant)     21055.351834  559.162143               37.655  .0000

The following new variables are being created:

  Name        Label

  FIT_9       Fit for MEGABUCK from CURVEFIT, MOD_9 LINEAR
  ERR_9       Error for MEGABUCK from CURVEFIT, MOD_9 LINEAR
```



Curve Fit

Dependent variable.. MASSMILL Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R	.23752
R Square	.05641
Adjusted R Square	.04784
Standard Error	5822.64083

Analysis of Variance:

	DF	Sum of Squares	Mean Square
Regression	1	222965378.3	222965378.3
Residuals	110	3729346092.1	33903146.3

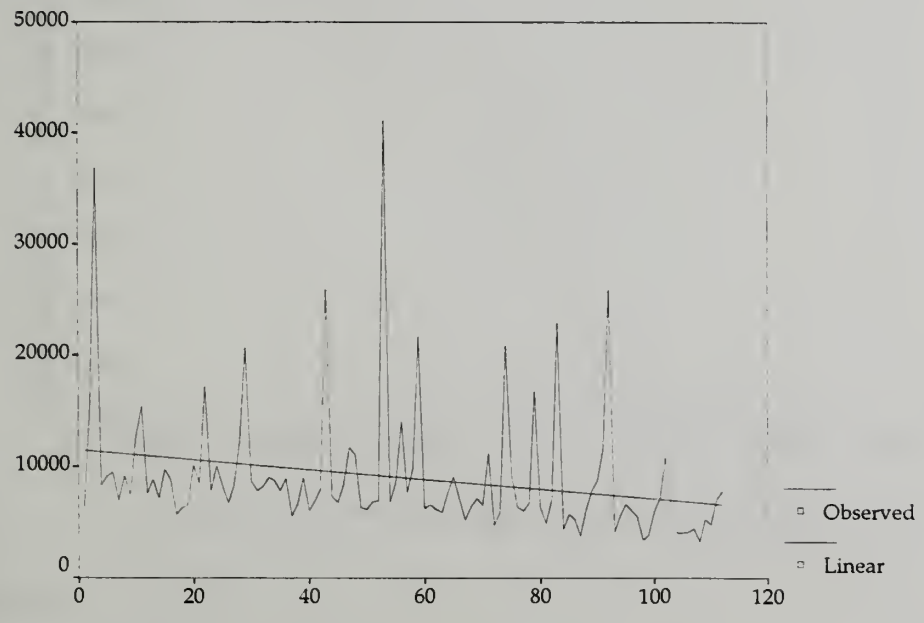
F = 6.57654 Signif F = .0117

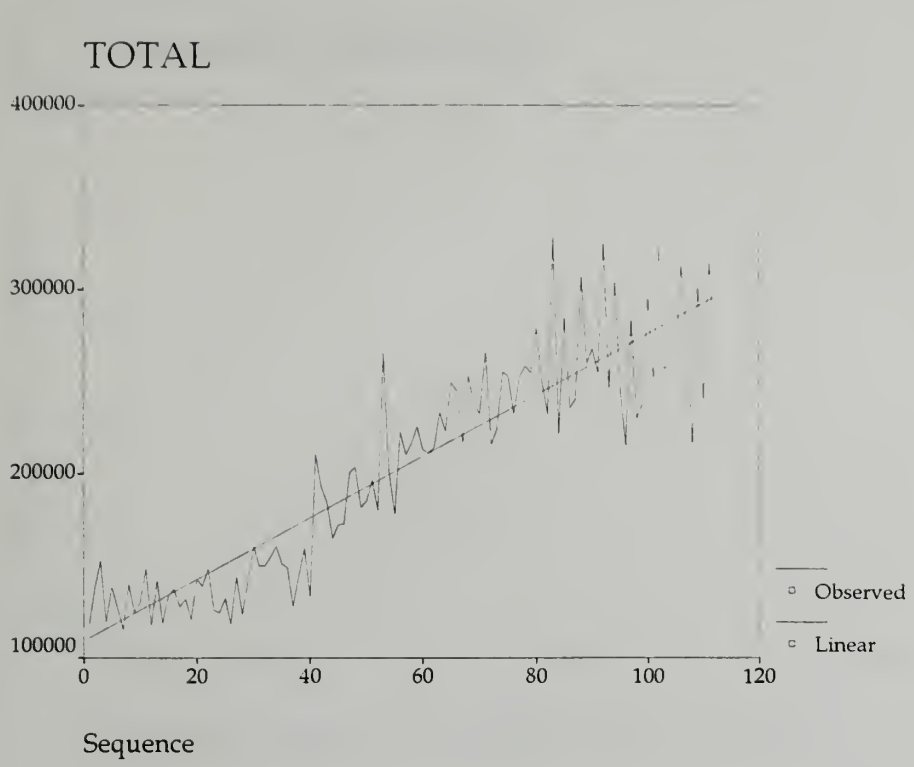
---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
Time	-43.641495	17.017702	-.237516	-2.564	.0117
(Constant)	11468.467664	1107.785708		10.353	.0000

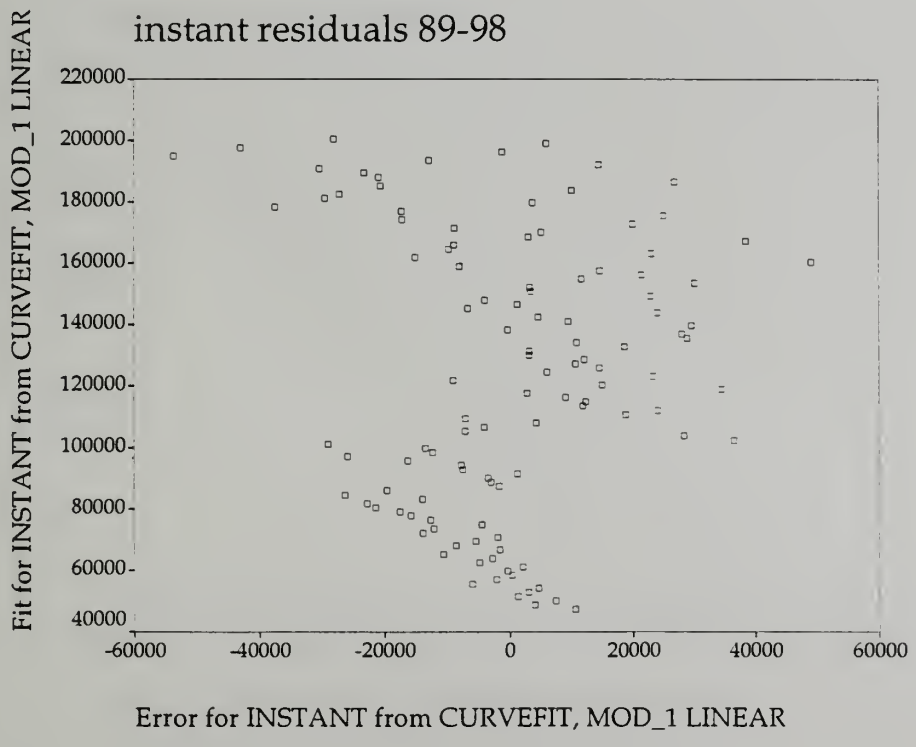
```
Dependent variable.. TOTAL              Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .90819
R Square             .82480
Adjusted R Square    .82321
Standard Error  25141.89875

            Analysis of Variance:

                 DF   Sum of Squares      Mean Square

Regression        1   327348690430.5   327348690430.5
Residuals       110    69532658011.0      632115072.8

F =     517.86250       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time             1672.192243   73.481663    .908186     22.757  .0000
(Constant)     109200.879344 4783.368390                 22.829  .0000

The following new variables are being created:

  Name        Label

  FIT_11      Fit for MASSMILL from CURVEFIT, MOD_11 LINEAR
  ERR_11      Error for MASSMILL from CURVEFIT, MOD_11 LINEAR
  FIT_12      Fit for TOTAL from CURVEFIT, MOD_11 LINEAR
  ERR_12      Error for TOTAL from CURVEFIT, MOD_11 LINEAR
```

MASSMILL

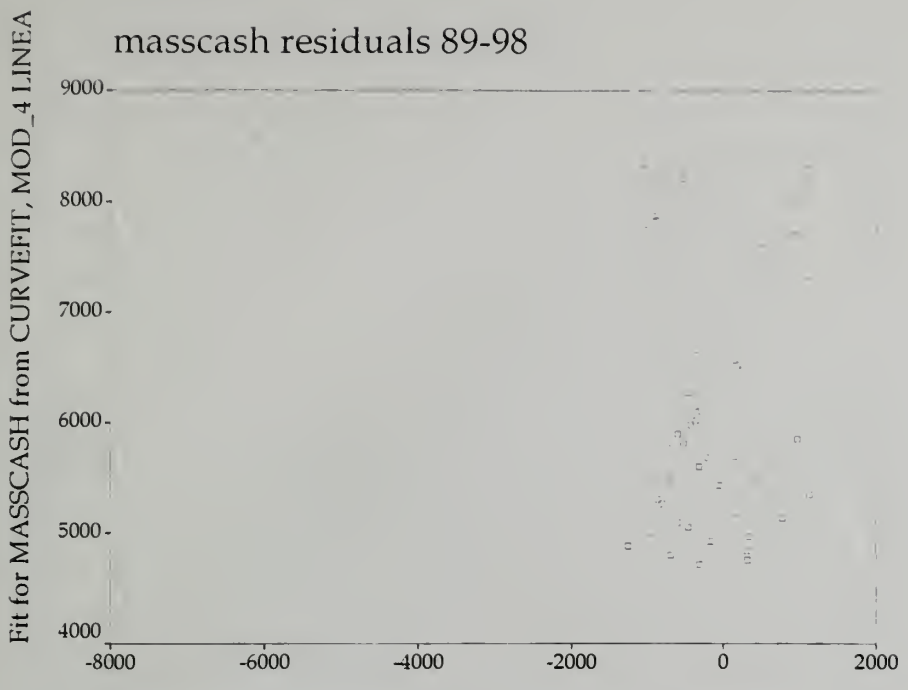



TOTAL
400000
300000
200000
100000
0
20
40
60
80
100
120
Observed
Linear
Sequence

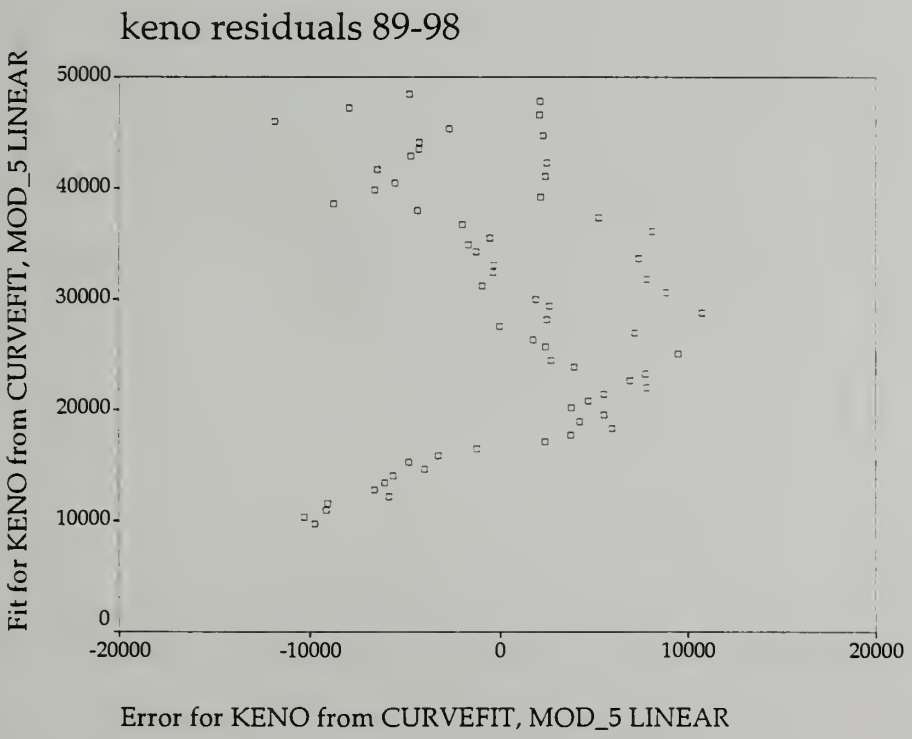
Graph


instant residuals 89-98
Fit for INSTANT from CURVEFIT, MOD_1 LINEAR
220000
200000
180000
160000
140000
120000
100000
80000
60000
40000
-60000
-40000
-20000
0
20000
40000
60000
Error for INSTANT from CURVEFIT, MOD_1 LINEAR

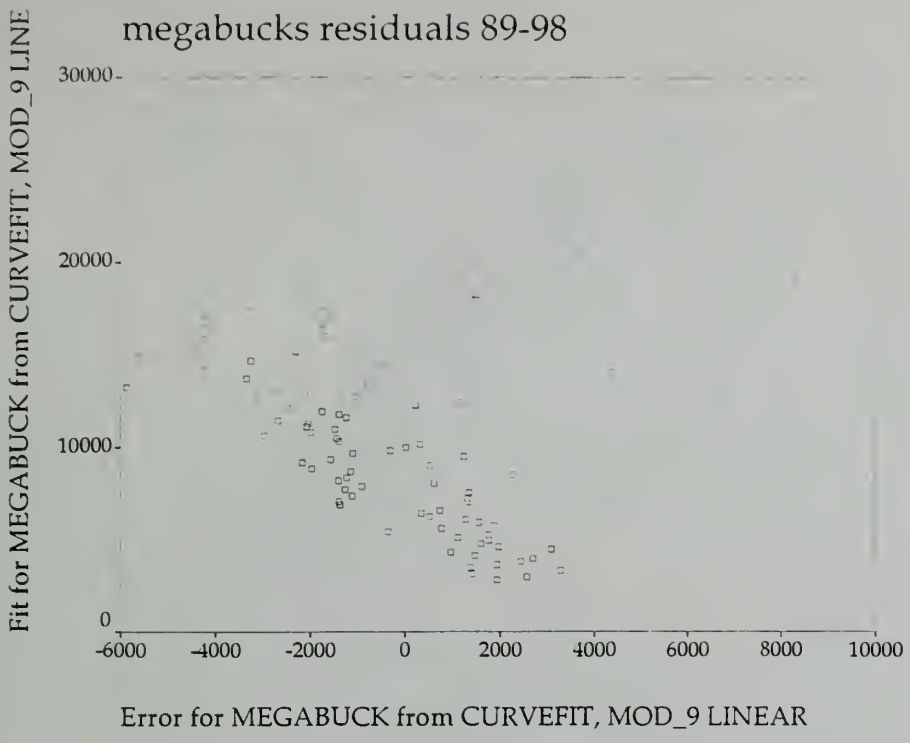
Graph


masscash residuals 89-98
Fit for MASSCASH from CURVEFIT, MOD_4 LINEA
9000
8000
7000
6000
5000
4000
-8000
-6000
-4000
-2000
0
2000
Error for MASSCASH from CURVEFIT, MOD_4 LINEAR

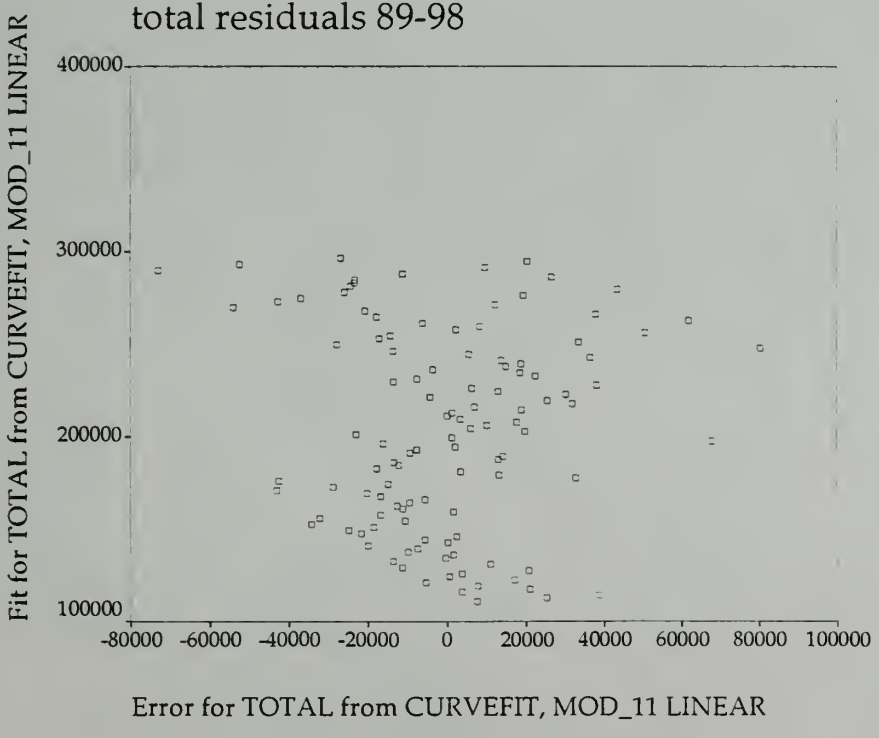
Graph


keno residuals 89-98
Fit for KENO from CURVEFIT, MOD_5 LINEAR
50000
40000
30000
20000
10000
0
-20000
-10000
0
10000
20000
Error for KENO from CURVEFIT, MOD_5 LINEAR

Graph


megabucks residuals 89-98
Fit for MEGABUCK from CURVEFIT, MOD_9 LINE
30000
20000
10000
0
-6000
-4000
-2000
0
2000
4000
6000
8000
10000
Error for MEGABUCK from CURVEFIT, MOD_9 LINEAR

Graph


total residuals 89-98
Fit for TOTAL from CURVEFIT, MOD_11 LINEAR
400000
300000
200000
100000
-80000
-60000
-40000
-20000
0
20000
40000
60000
80000
100000
Error for TOTAL from CURVEFIT, MOD_11 LINEAR

APPENDIX D

REGRESSION ANALYSIS FOR PRE AND POST INTRODUCTION OF PLUS $1 INSTANT TICKETS (WITH CORRELATION MATRICES)

PRE $1 PLUS INSTANT TICKETS CORRELATION COEFFICIENT MATIRX, MASSACHUSETTS STATE LOTTERY

	INST	NUMB	MCAS	PTAB	MEGA	MMIL	TSAL
INST		-.11	.35	-.11	-.40*	.01	.43*
NUMB	-.11		-.35	-.78	.61**	-.05	.56**
MCAS	.35	-.35		-.69	-.46	.05	.08
PTAB	-.11	-.78	-.69		-.75	.998*	.02
MEGA	-.40*	.61**	-.46	-.75		.08	.29
MMIL	.01	-.05	.05	.998*	.08		.62**
TSAL	.43*	.56**	.08	.02	.29	.62**	

*. Correlation is significant at the 0.05 level
**. Correlation is significant at the 0.01 level

INST = Instant NUMB = Numbers MCAS = Mass Cash PTAB = Pull Tabs
MEGA = Megabucks MMIL = Mass Millions TSAL = Total Sales

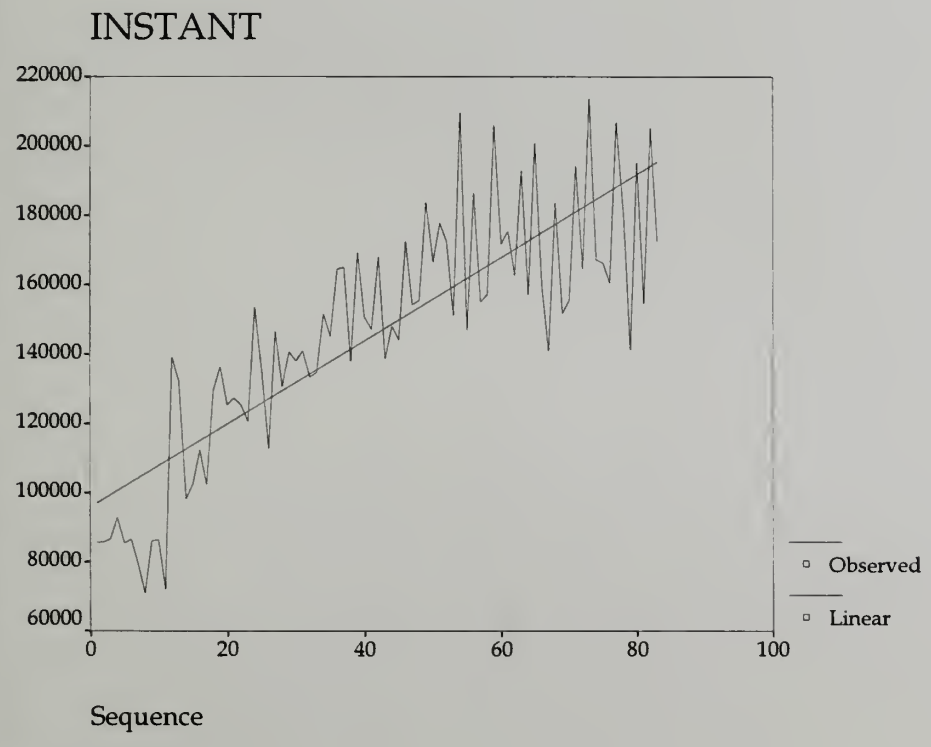
POST $1 PLUS INSTANT TICKET CORRELATION COEFFICIENT MATRIX, MASSACHUSETTS STATE LOTTERY, 1992-98

	INST	BIGA	NUMB	MCAS	KENO	CHAR	BEAN	PTAB	MEGA	MMIL	TSAL
INST		.04	-.24*	-.53**	.80**	-.14	-.32*	-.19	-.64**	.01	.98**
BIG	.04		.09	-.16	.17	-.27	-.26	.24	.04	.24	.17
NUM	-.24*	.09		.78**	-.16	.40**	.30*	.30**	.51**	.33**	-.15
MCAS	-.53**	-.16	.78**		-.58**	.52**	.35*	.49**	.81**	.39**	-.48**
KENO	.80**	.17	-.16	-.58**		-.23	-.38**	-.61**	-.71**	-.19	.81**
CHAR	-.14	-.27	.40**	.52**	-.23		.61**	.25	.47**	.12	-.08
BEAN	-.32*	-.26	.30*	.35*	-.38**	.61**		.16	.38**	.03	-.27
PTAB	-.19	.24	.30**	.49**	-.61**	.25	.16		.45**	.38**	-.21
MEGA	-.64**	.04	.51**	.81**	-.71**	.47**	.38**	.45**		.35**	-.58**
MMIL	-.01	.24	.33**	.39**	-.19	.12	.03	.38**	.35**		.13
TSAL	.98**	.17	-.15	-.48**	.81**	-.08	-.27	-.21	-.58**	.13	

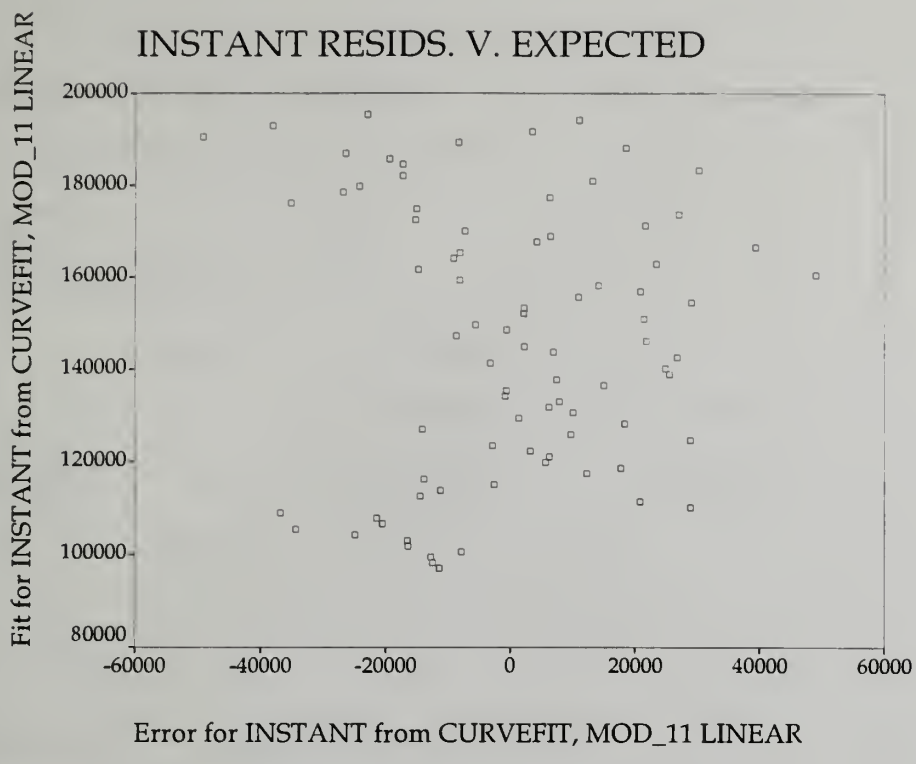
*. Correlation is significant at the 0.05 level
**. Correlation is significant at the 0.01 level

INST = Instant
BIGA = Big Game
NUMB = Numbers
MCAS = Mass Cash
KENO = Keno
CHAR = Charity
BEAN = Beano
PTAB = Pull Tabs
MEGA = Megabucks
MMIL = Mass Millions
TSAL = Total Sales

```
Dependent variable.. INSTANT          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .82946
R Square             .68800
Adjusted R Square    .68415
Standard Error  19591.21533

           Analysis of Variance:

                DF   Sum of Squares      Mean Square

Regression       1    68554837783.5    68554837783.5
Residuals       81    31089073175.7      383815718.2

F =     178.61394       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time            1199.565761   89.756598    .829457    13.365  .0000
(Constant)     95796.478989 4339.989104               22.073  .0000

The following new variables are being created:

  Name        Label

  FIT_1       Fit for INSTANT from CURVEFIT, MOD_11 LINEAR
  ERR_1       Error for INSTANT from CURVEFIT, MOD_11 LINEAR
```



Graph



Curve Fit

```
MODEL:  MOD_12.
```

Dependent variable.. BIGGAME Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R	.07892
R Square	.00623
Adjusted R Square	-.03199
Standard Error	2835.44866

Analysis of Variance:

	DF	Sum of Squares	Mean Square
Regression	1	1310102.8	1310102.8
Residuals	26	209033997.1	8039769.1

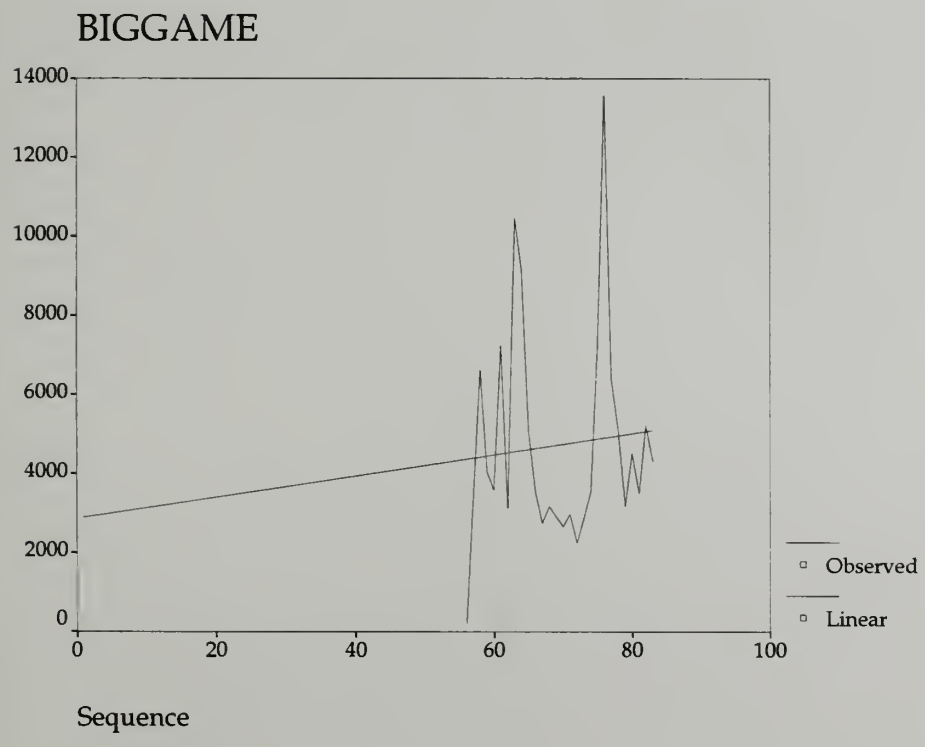
F = .16295 Signif F = .6898

---------- Variables in the Equation ----------

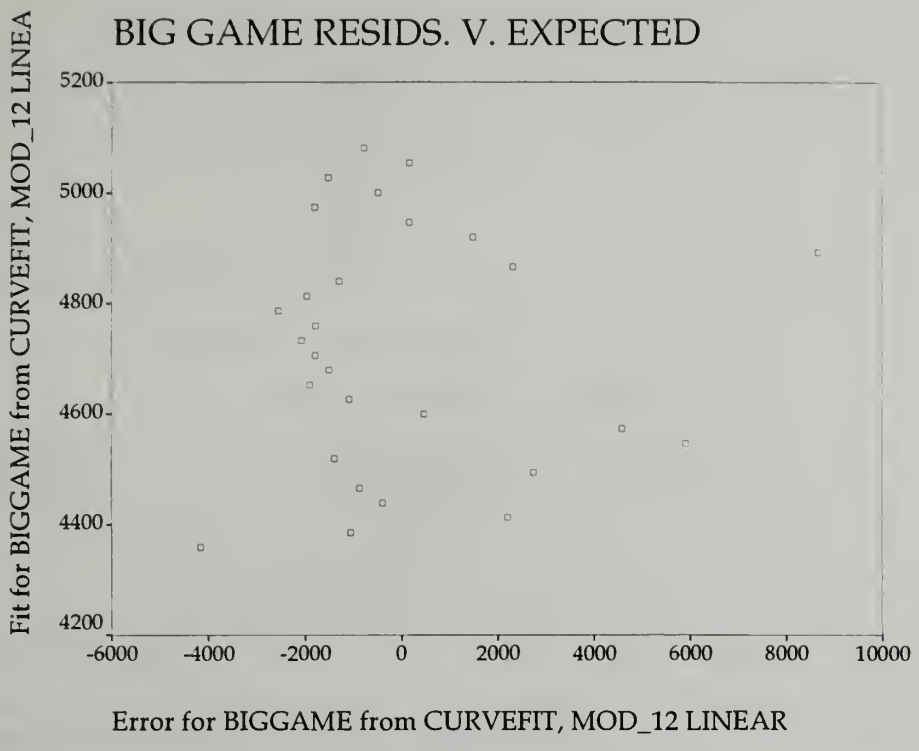
Variable	B	SE B	Beta	T	Sig T
Time	26.778325	66.336494	.078920	.404	.6898
(Constant)	2858.834975	4641.421849		.616	.5433

The following new variables are being created:

Name	Label
FIT_2	Fit for BIGGAME from CURVEFIT, MOD_12 LINEAR
ERR_2	Error for BIGGAME from CURVEFIT, MOD_12 LINEAR



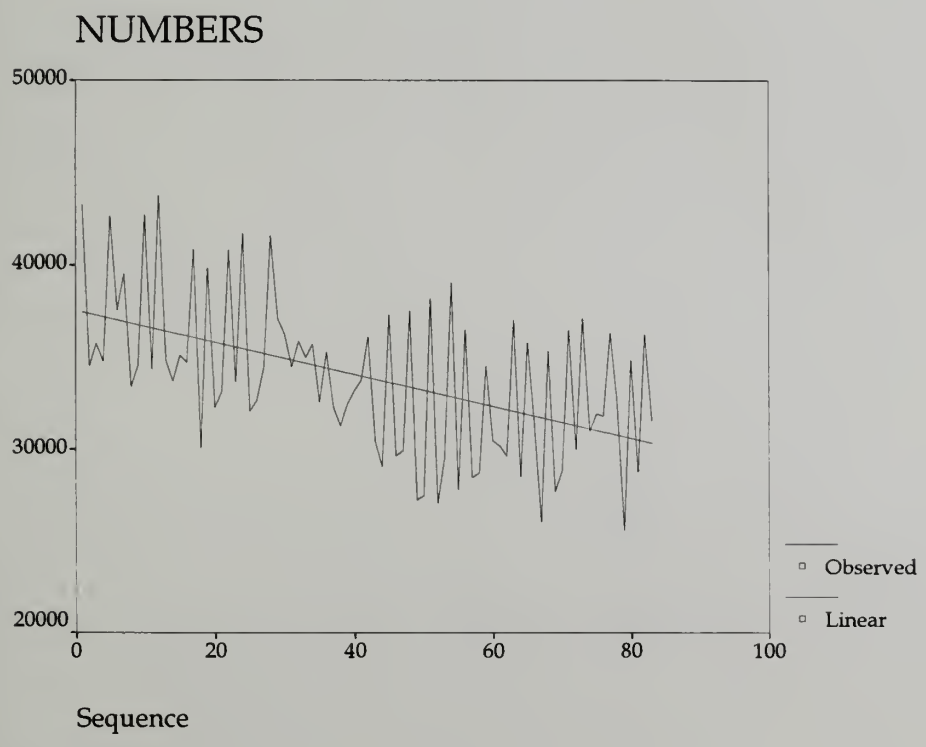
Graph



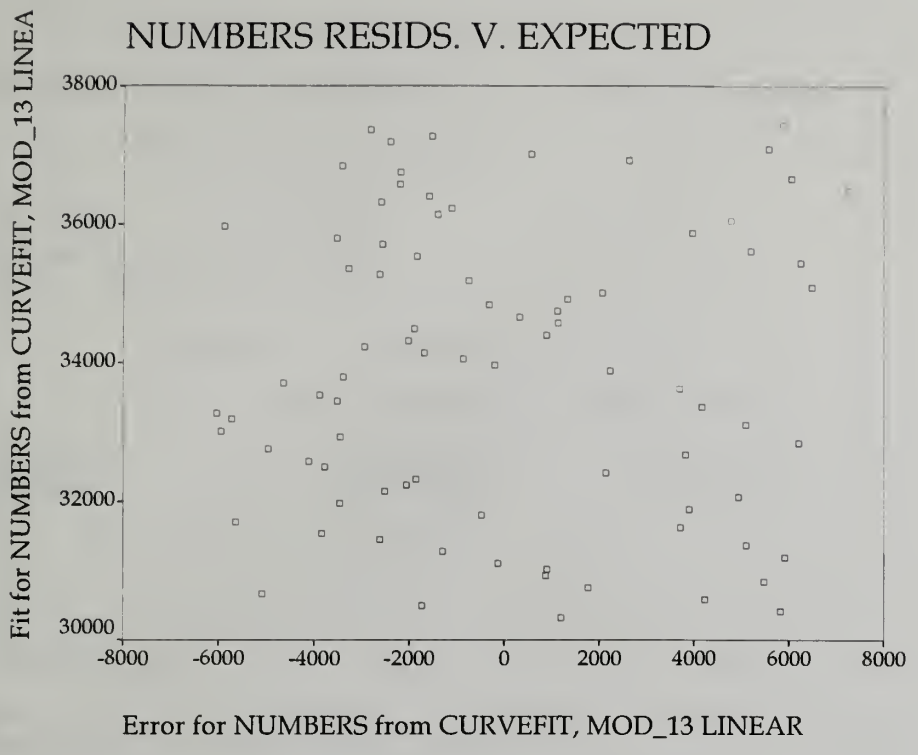
Curve Fit

```
MODEL:  MOD_13.
```

```
Dependent variable.. NUMBERS          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .49156
R Square             .24163
Adjusted R Square    .23227
Standard Error   3735.38920

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1      360102569.3      360102569.3
Residuals      81     1130203727.5       13953132.4

F =      25.80801       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time              -86.939696   17.113580   -.491559    -5.080  .0000
(Constant)      37537.961211  827.490696               45.364  .0000

The following new variables are being created:

  Name        Label

  FIT_3       Fit for NUMBERS from CURVEFIT, MOD_13 LINEAR
  ERR_3       Error for NUMBERS from CURVEFIT, MOD_13 LINEAR
```



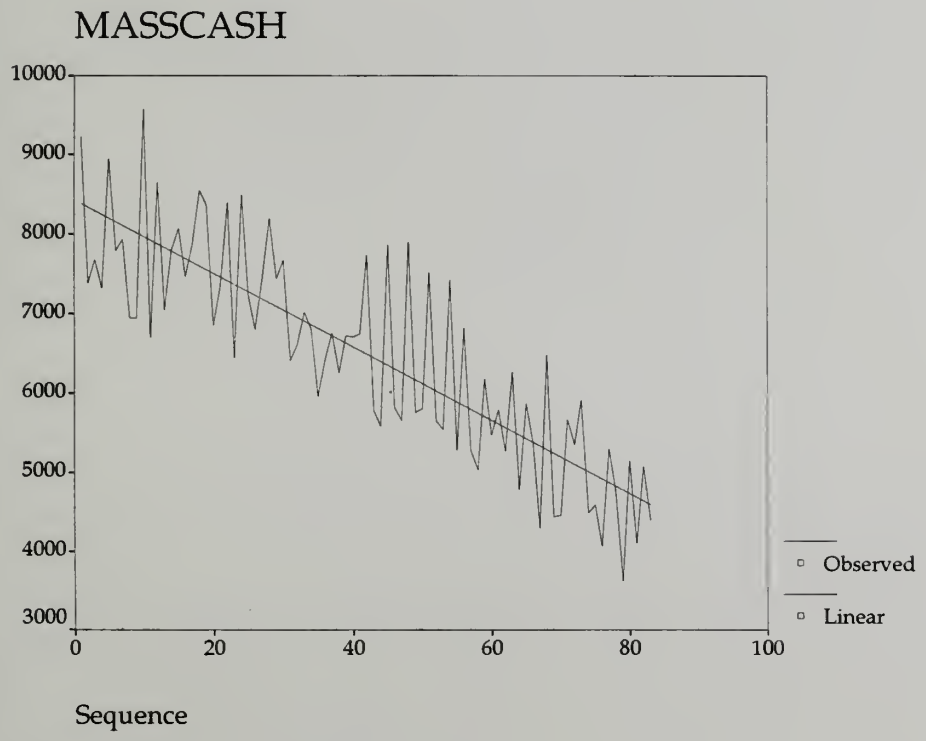
Graph



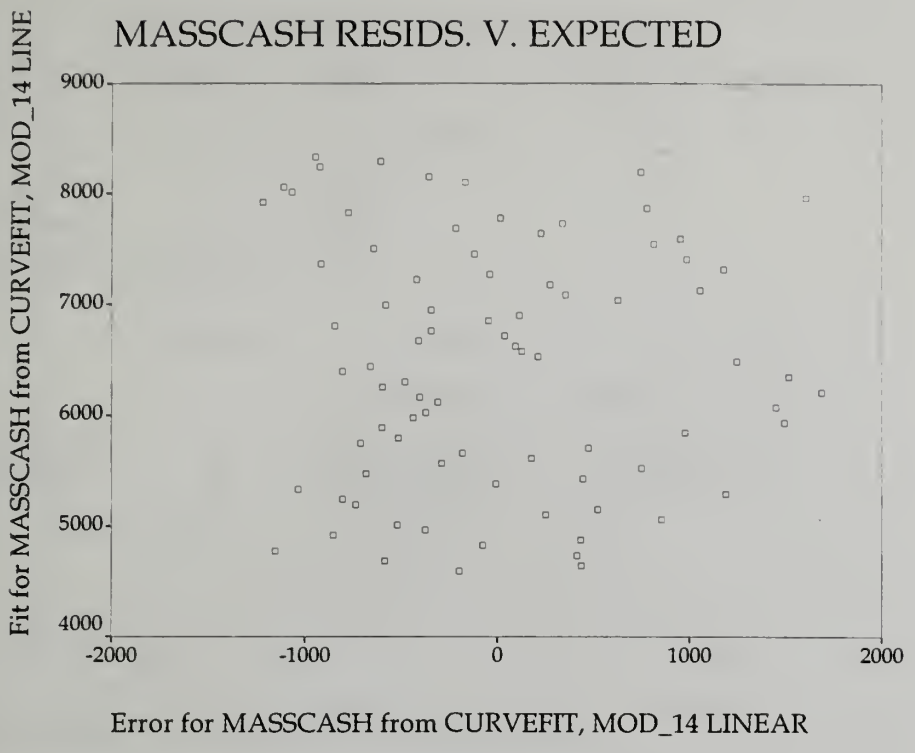
Curve Fit

```
MODEL:  MOD_14.
```

```
Dependent variable.. MASSCASH          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .83212
R Square             .69243
Adjusted R Square    .68863
Standard Error    747.28506

            Analysis of Variance:

                DF   Sum of Squares      Mean Square

Regression       1      101831021.9      101831021.9
Residuals       81       45233232.1         558435.0

F =     182.35073       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta         T  Sig T

Time              -46.232253    3.423665   -.832121   -13.504  .0000
(Constant)       8428.754628  165.544045               50.915  .0000

The following new variables are being created:

  Name         Label

  FIT_4        Fit for MASSCASH from CURVEFIT, MOD_14 LINEAR
  ERR_4        Error for MASSCASH from CURVEFIT, MOD_14 LINEAR
```



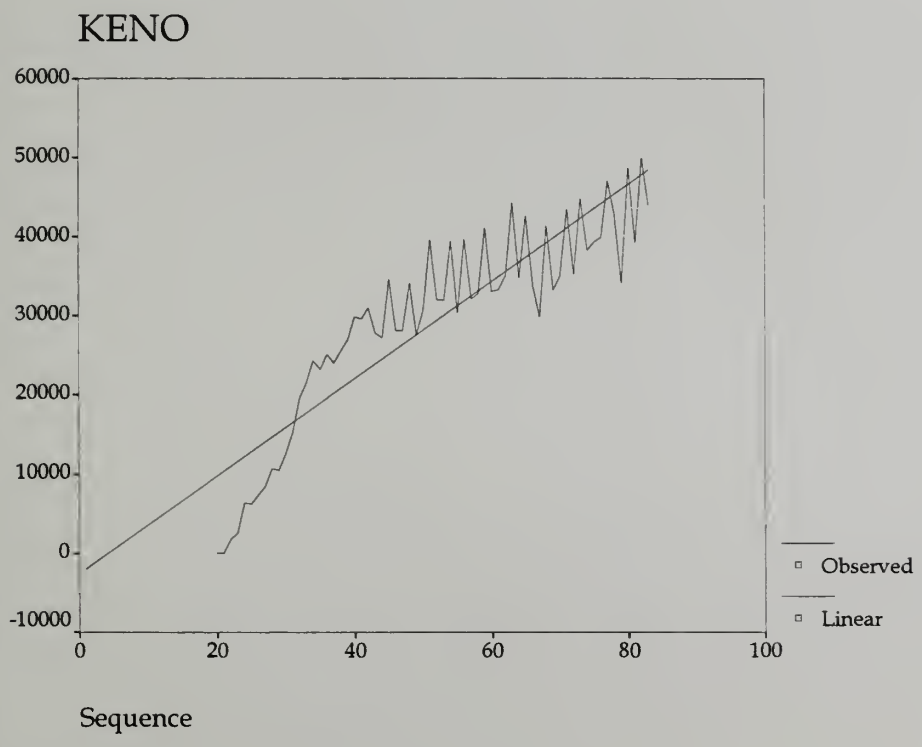
Graph



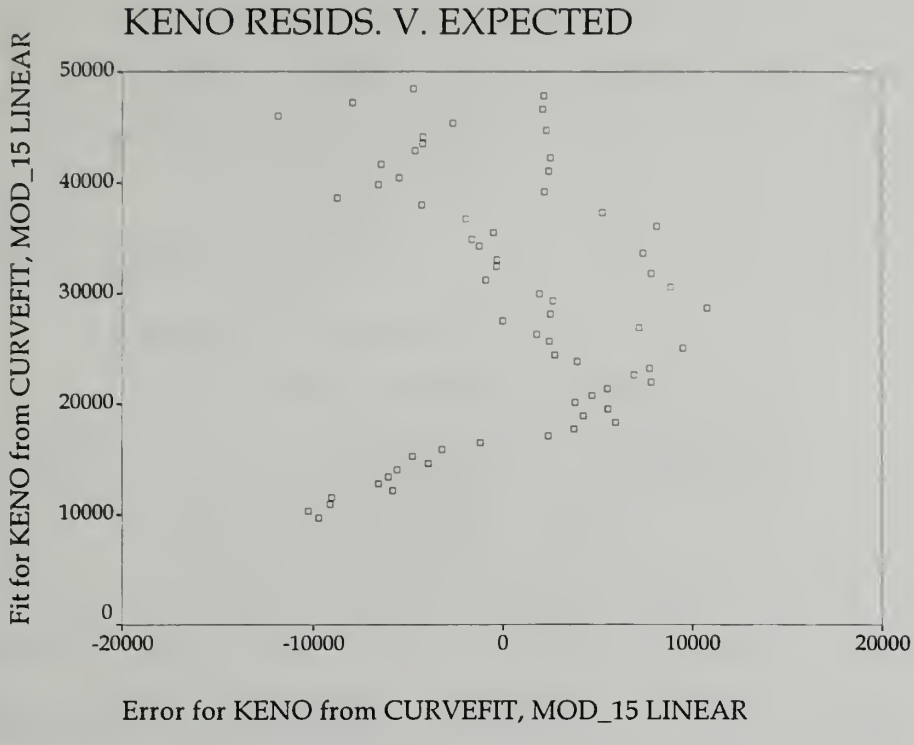
Curve Fit

```
MODEL:  MOD_15.
```

```
Dependent variable.. KENO              Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .89587
R Square             .80259
Adjusted R Square    .79941
Standard Error   5724.24065

           Analysis of Variance:

                DF    Sum of Squares      Mean Square

Regression       1     8259520135.3     8259520135.3
Residuals       62     2031549726.5       32766931.1

F =     252.06877       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time              614.965980   38.733930    .895874     15.877  .0000
(Constant)      -2591.060462 2119.245150                -1.223  .2261

The following new variables are being created:

  Name        Label

  FIT_5       Fit for KENO from CURVEFIT, MOD_15 LINEAR
  ERR_5       Error for KENO from CURVEFIT, MOD_15 LINEAR
```



Graph



Curve Fit

```
MODEL:  MOD_16.
```

Dependent variable.. CHARITY Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R	.38325
R Square	.14688
Adjusted R Square	.12834
Standard Error	108.12738

Analysis of Variance:

	DF	Sum of Squares	Mean Square
Regression	1	92596.07	92596.066
Residuals	46	537810.41	11691.531

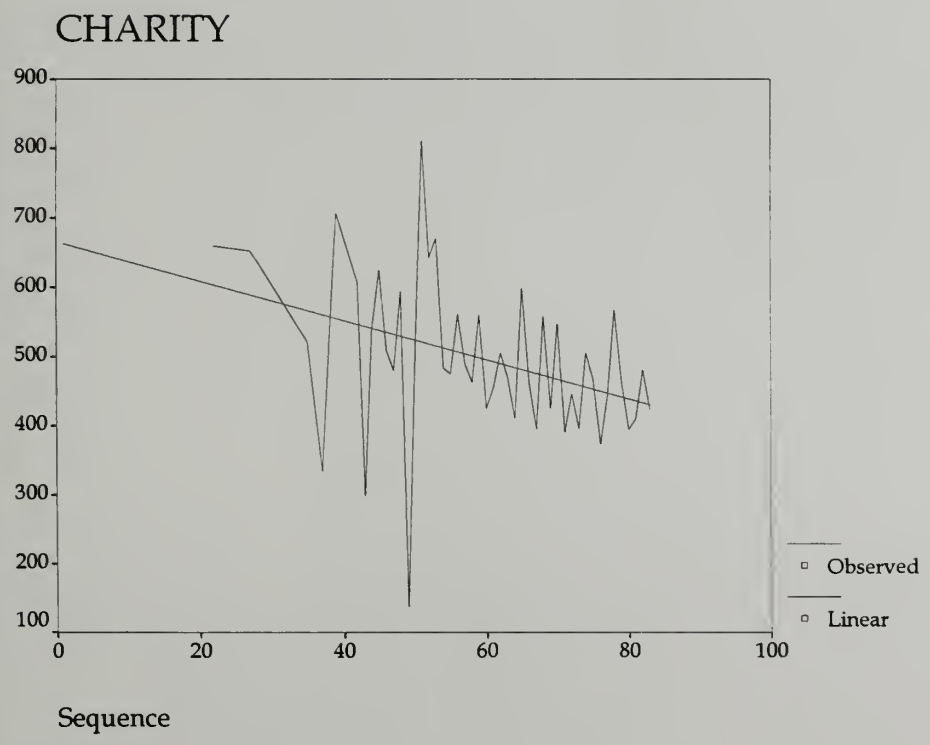
F = 7.91993 Signif F = .0072

---------- Variables in the Equation ----------

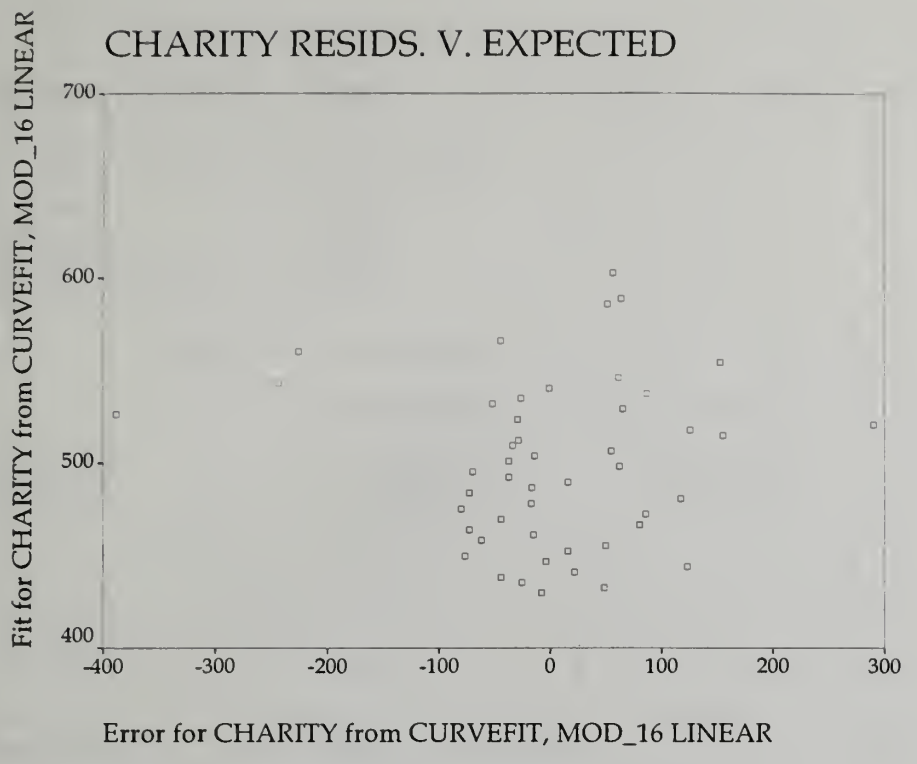
Variable	B	SE B	Beta	T	Sig T
Time	-2.838627	1.008667	-.383253	-2.814	.0072
(Constant)	665.459525	61.137641		10.885	.0000

The following new variables are being created:

Name	Label
FIT_6	Fit for CHARITY from CURVEFIT, MOD_16 LINEAR
ERR_6	Error for CHARITY from CURVEFIT, MOD_16 LINEAR



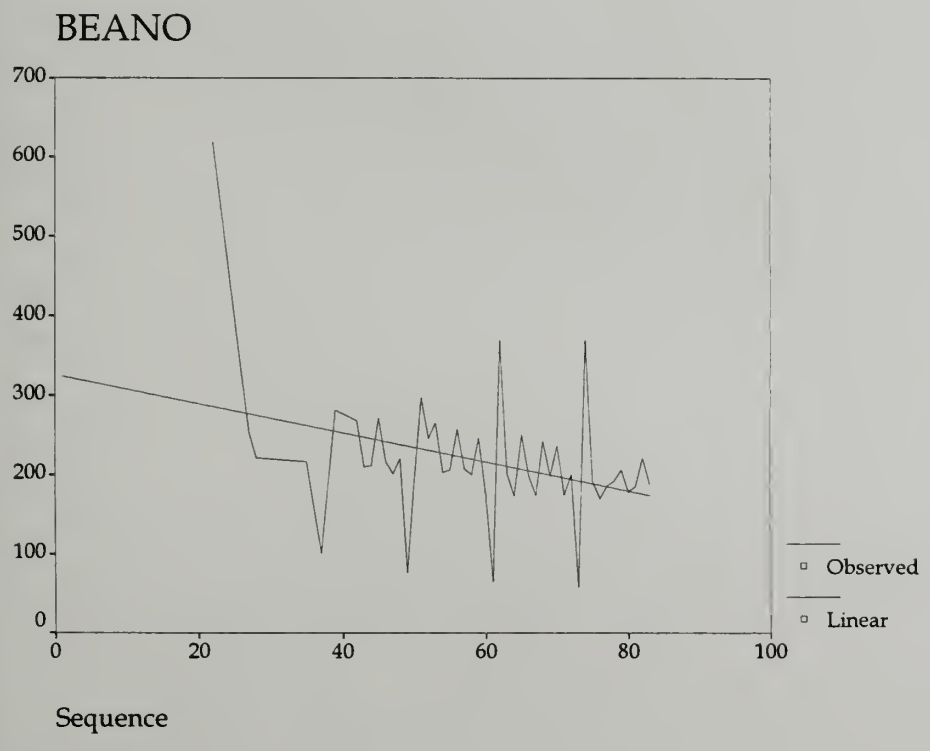
Graph



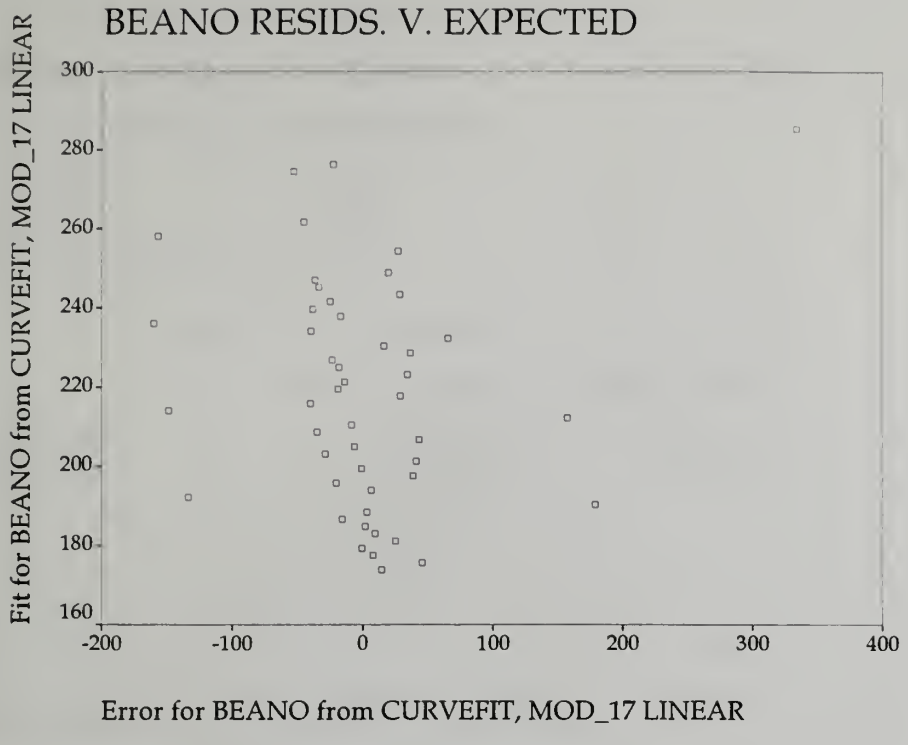
Curve Fit

```
MODEL:  MOD_17.
```

```
Dependent variable.. BEANO              Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R            .34023
R Square              .11576
Adjusted R Square     .09654
Standard Error      79.95683

            Analysis of Variance:

                DF    Sum of Squares      Mean Square

Regression       1         38499.48        38499.483
Residuals       46        294082.33         6393.094

F =       6.02204       Signif F =  .0180

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time                -1.830373     .745878   -.340234     -2.454  .0180
(Constant)         325.704955   45.209379                 7.204  .0000

The following new variables are being created:

  Name        Label

  FIT_7       Fit for BEANO from CURVEFIT, MOD_17 LINEAR
  ERR_7       Error for BEANO from CURVEFIT, MOD_17 LINEAR
```



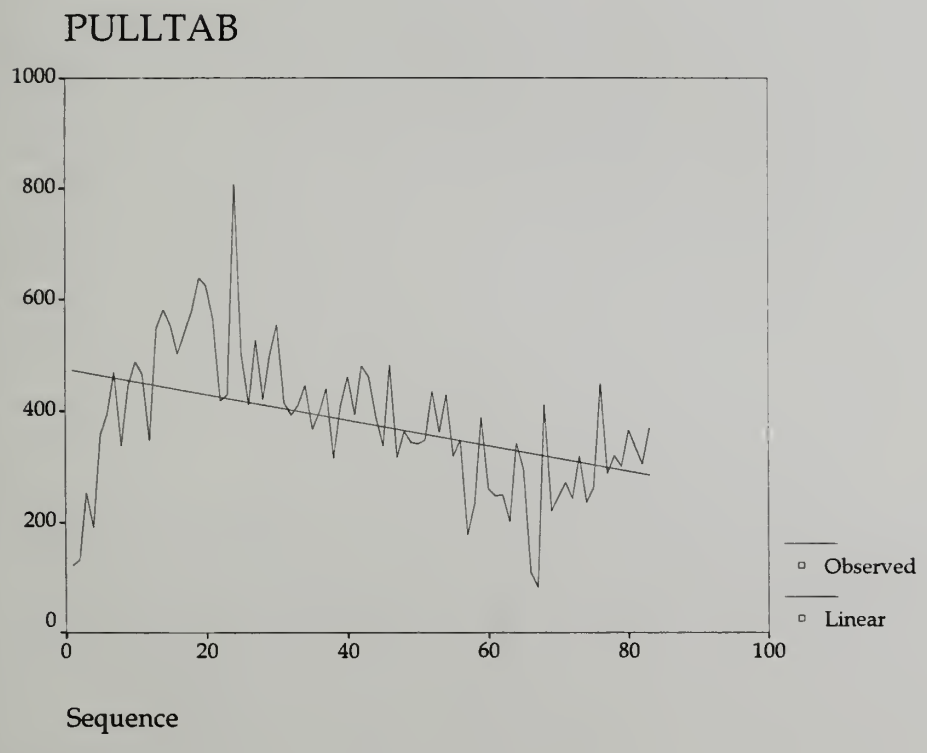
Graph



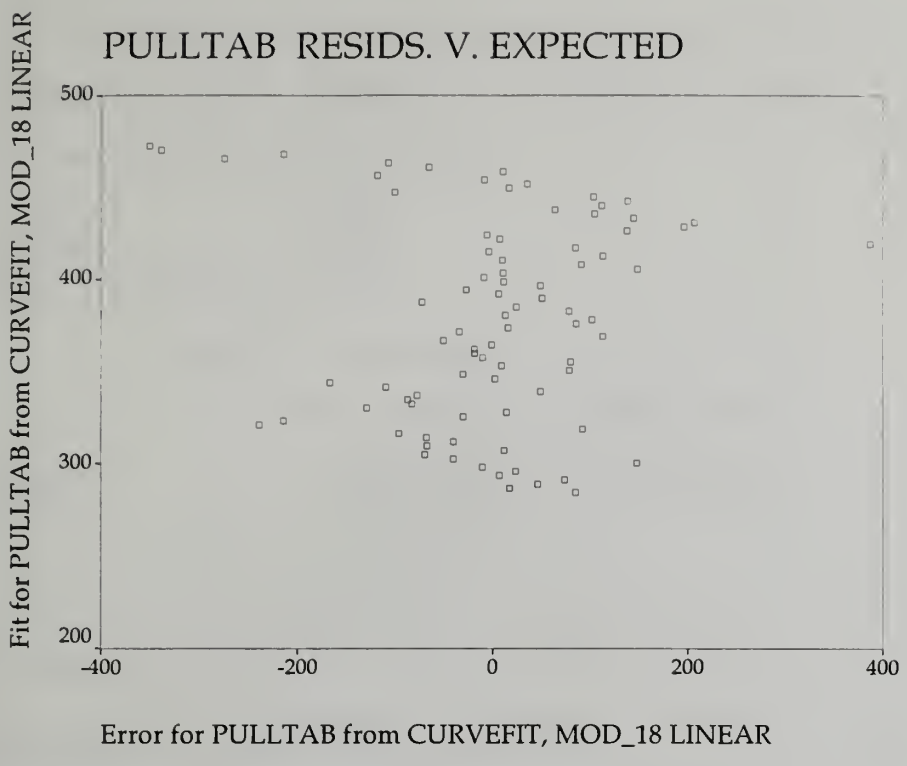
Curve Fit

```
MODEL:  MOD_18.
```

```
Dependent variable.. PULLTAB          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .43074
R Square             .18554
Adjusted R Square    .17548
Standard Error    116.66105

            Analysis of Variance:

                DF   Sum of Squares      Mean Square

Regression       1         251127.2        251127.22
Residuals       81        1102393.9         13609.80

F =      18.45194       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta         T  Sig T

Time                -2.295894     .534479   -.430739    -4.296  .0000
(Constant)         474.789010   25.843609               18.372  .0000

The following new variables are being created:

  Name        Label

  FIT_8       Fit for PULLTAB from CURVEFIT, MOD_18 LINEAR
  ERR_8       Error for PULLTAB from CURVEFIT, MOD_18 LINEAR
```



Graph

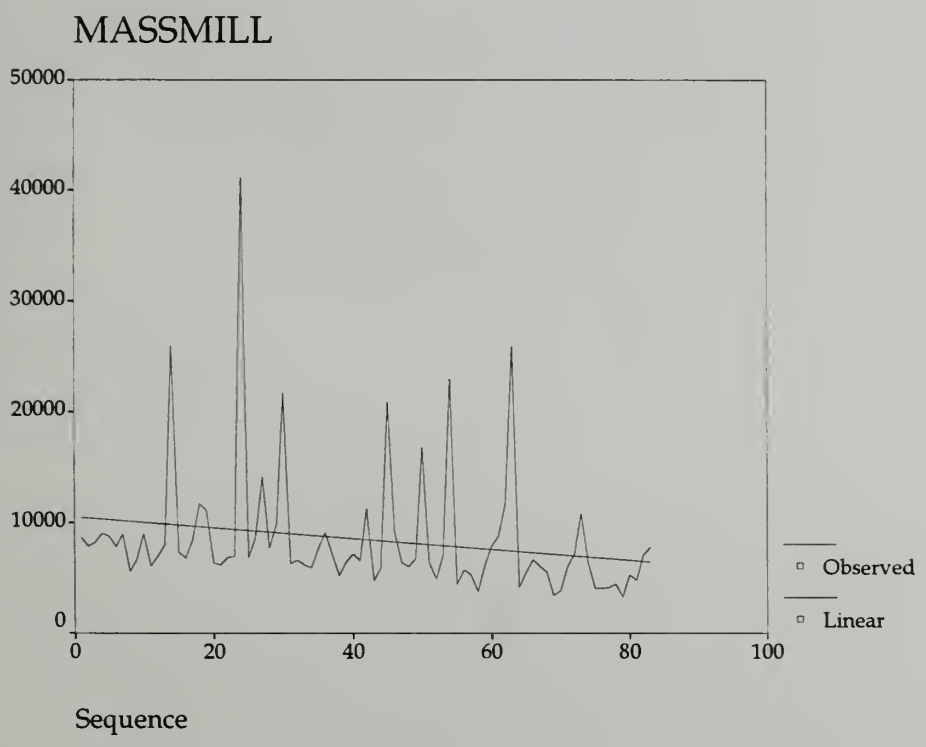


Graph

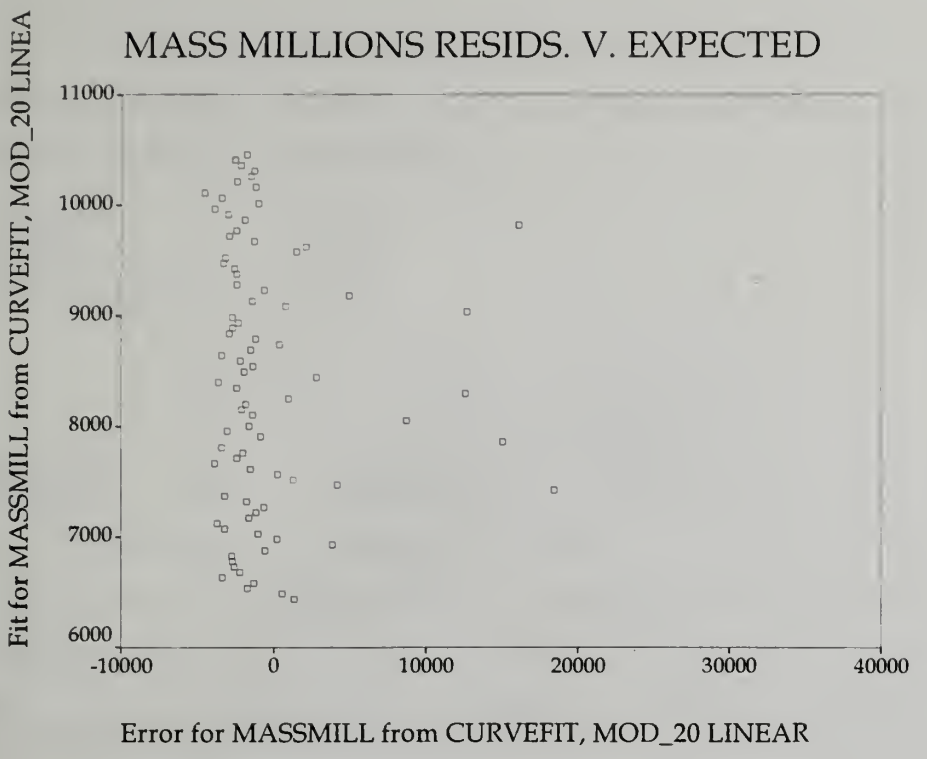
Curve Fit

```
MODEL:  MOD_20.
```

```
Dependent variable.. MASSMILL          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .20235
R Square             .04095
Adjusted R Square    .02911
Standard Error    5748.50238

            Analysis of Variance:

                DF   Sum of Squares      Mean Square

Regression       1      114279296.0      114279296.0
Residuals       81     2676667649.6       33045279.6

F =       3.45826       Signif F =  .0666

-------------------- Variables in the Equation --------------------

Variable                    B         SE B       Beta         T  Sig T

Time              -48.976617   26.336601   -.202352    -1.860  .0666
(Constant)      10502.849251 1273.450231                8.248  .0000

The following new variables are being created:

  Name        Label

  FIT_10      Fit for MASSMILL from CURVEFIT, MOD_20 LINEAR
  ERR_10      Error for MASSMILL from CURVEFIT, MOD_20 LINEAR
```



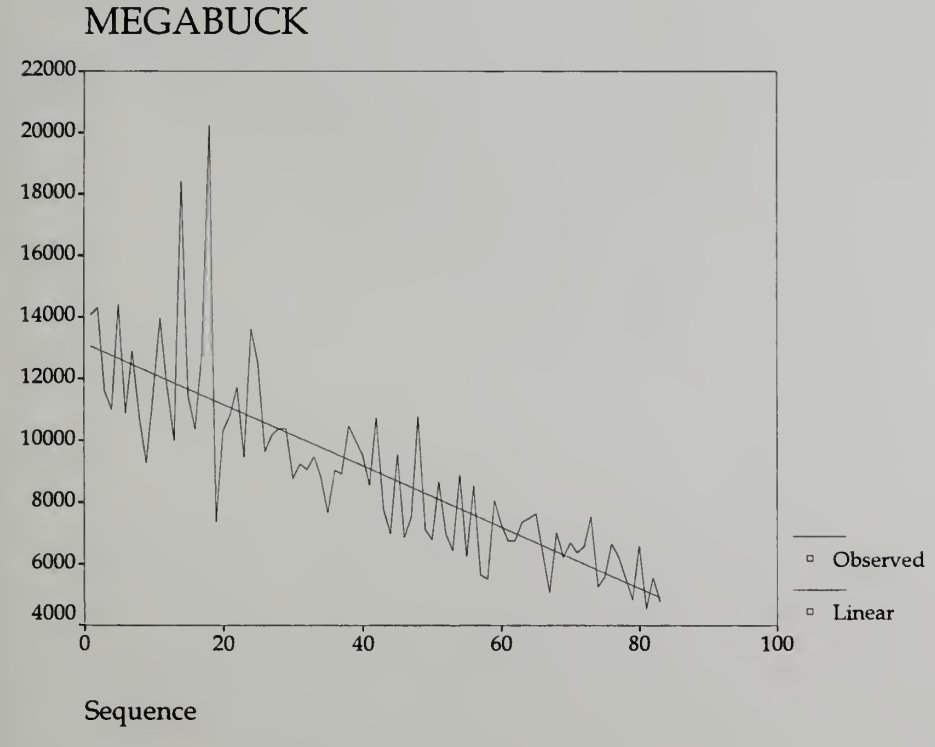
Graph



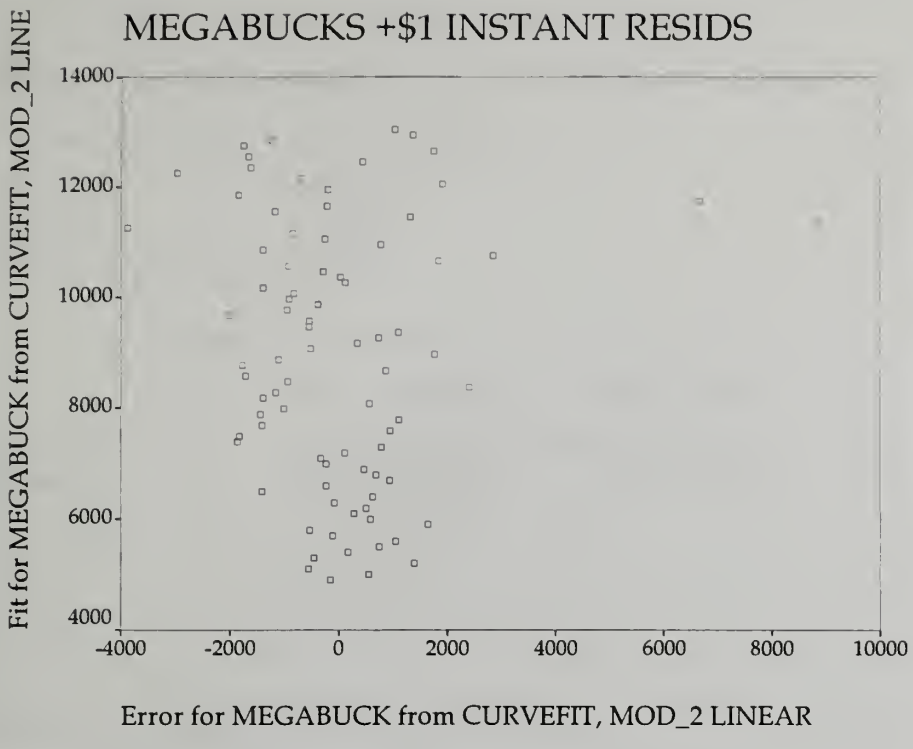
Curve Fit

```
MODEL:  MOD_21.
```

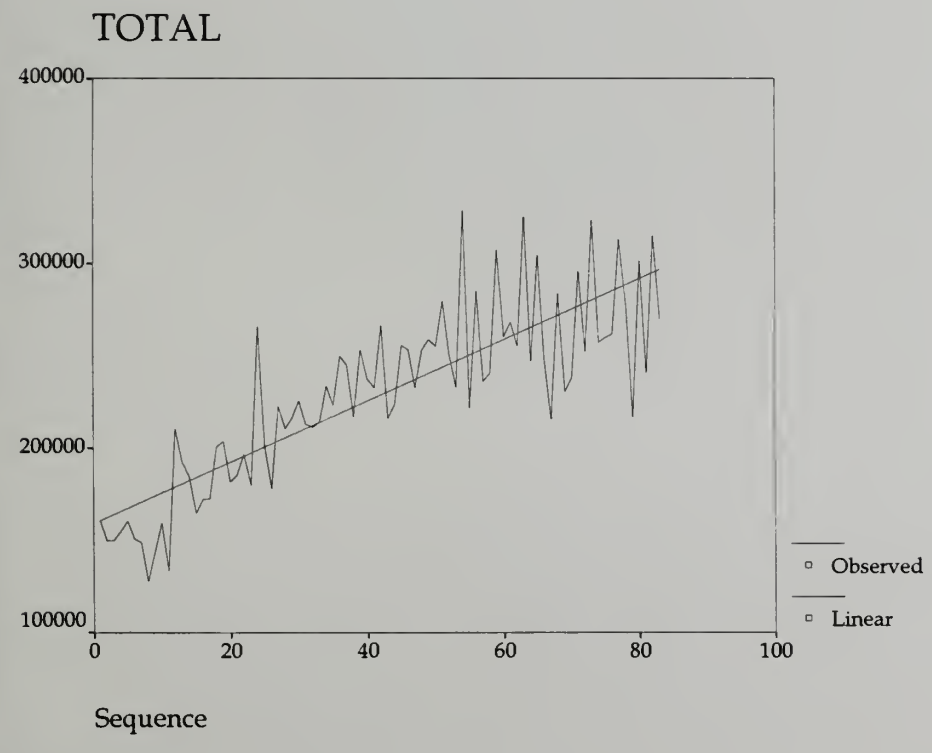
```
Dependent variable.. MEGABUCK          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .80810
R Square             .65302
Adjusted R Square    .64873
Standard Error   1754.18900

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1      469090211.4      469090211.4
Residuals      81      249251503.3        3077179.1

F =     152.44164       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta         T  Sig T

Time              -99.227761    8.036767   -.808095   -12.347  .0000
(Constant)      13141.071995  388.600759               33.816  .0000

The following new variables are being created:

  Name        Label

  FIT_4       Fit for MEGABUCK from CURVEFIT, MOD_3 LINEAR
  ERR_4       Error for MEGABUCK from CURVEFIT, MOD_3 LINEAR
```



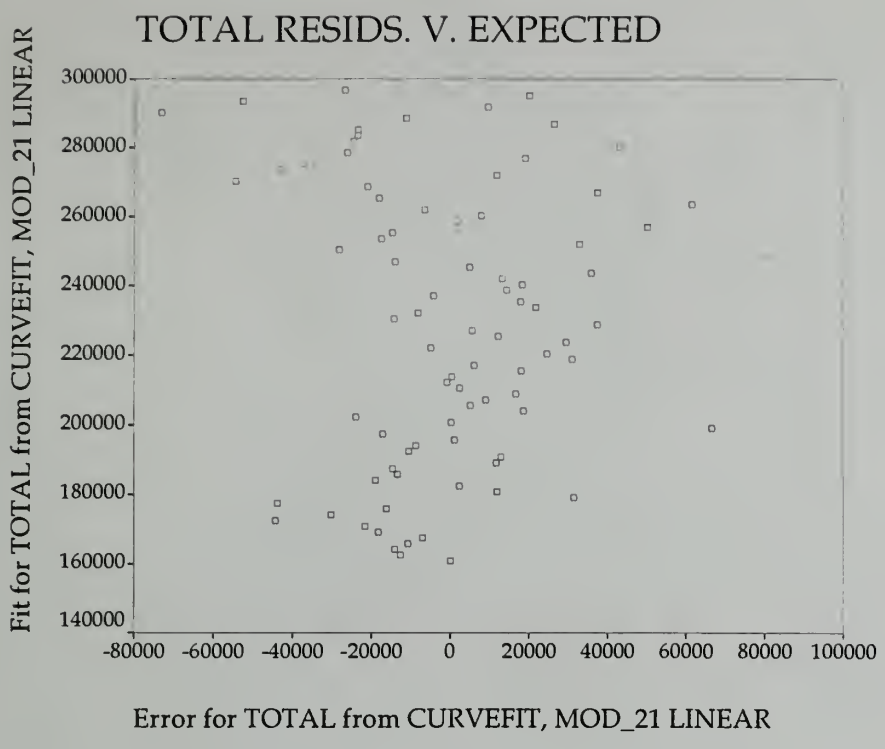
Graph


MEGABUCKS +$1 INSTANT RESIDS
Fit for MEGABUCK from CURVEFIT, MOD_2 LINE
14000
12000
10000
8000
6000
4000
-4000
-2000
0
2000
4000
6000
8000
10000
Error for MEGABUCK from CURVEFIT, MOD_2 LINEAR

```
Dependent variable.. TOTAL            Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .82593
R Square             .68216
Adjusted R Square    .67824
Standard Error  27432.39003

            Analysis of Variance:

                DF   Sum of Squares      Mean Square

Regression       1   130824810010.6   130824810010.6
Residuals       81    60955417825.9      752536022.5

F =     173.84525       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time            1657.105138  125.680718    .825930    13.185  .0000
(Constant)    159181.138407 6077.023389               26.194  .0000

The following new variables are being created:

  Name        Label

  FIT_11      Fit for TOTAL from CURVEFIT, MOD_21 LINEAR
  ERR_11      Error for TOTAL from CURVEFIT, MOD_21 LINEAR
```



Graph



Curve Fit

```
MODEL:  MOD_3.
```

APPENDIX E

REGRESSION ANALYSIS FOR PRE AND POST INTRODUCTION OF FOXWOODS CASINO (WITH CORRELATION MATRICES)

PRE FOXWOODS CORRELATION COEFFICIENT MATIRX, MASSACHUSETTS STATE LOTTERY

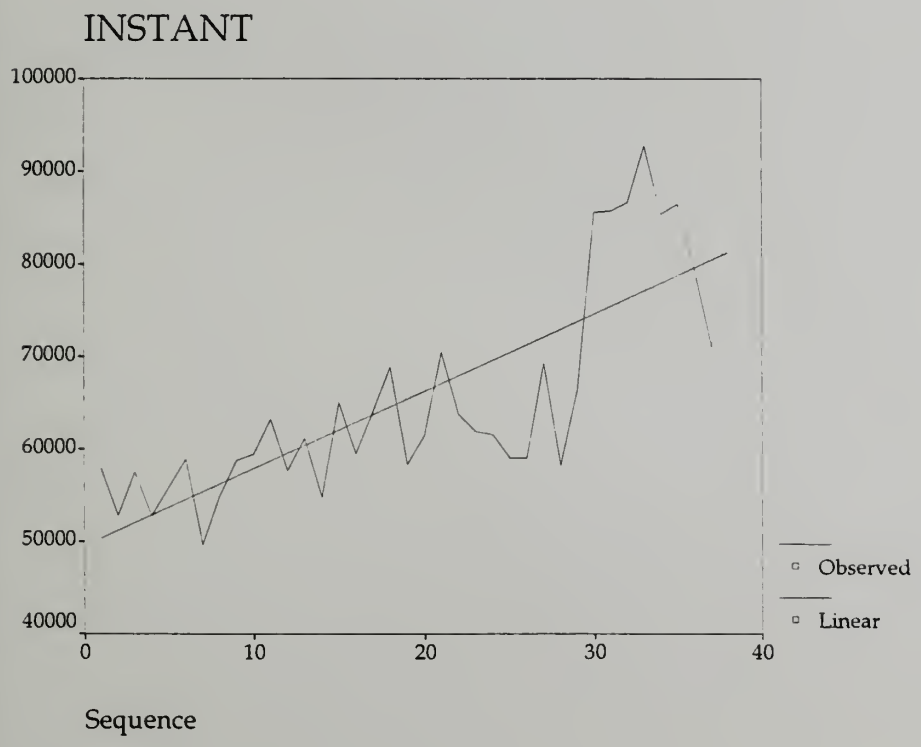
	INST	NUMB	MCAS	PTAB	MEGA	MMIL	TSAL
INST		.18	.01	.48	-.04	-.50	.81**
NUMB	.18		.95**	-.01	.72**	-.16	.62*
MCAS	.01	.95**		-.31	.80**	.02	.53
PTAB	.48	-.01	-.31		-.42	-.47	.19
MEGA	-.04	.72**	.80**	-.42		.01	.42
MMIL	.50	-.16	.02	-.47	.01		-.17
TSAL	.81**	.62*	.53	.19	.42	-.17	

*. Correlation is significant at the 0.05 level

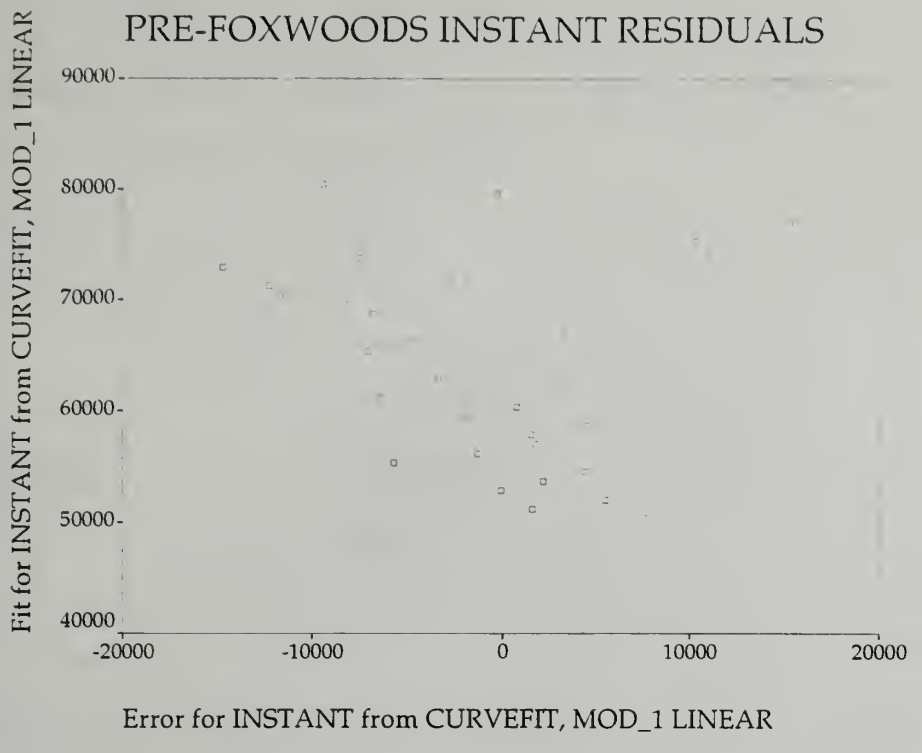
**. Correlation is significant at the 0.01 level

INST = Instant NUMB = Numbers MCAS = Mass Cash PTAB = Pull Tabs
MEGA = Megabucks MMIL = Mass Millions TSAL = Total Sales

```
Dependent variable.. INSTANT          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .79705
R Square             .63529
Adjusted R Square    .62516
Standard Error   7143.79144

           Analysis of Variance:

              DF   Sum of Squares      Mean Square

Regression     1     3200289241.6     3200289241.6
Residuals     36     1837215219.8       51033756.1

F =      62.70926       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time              836.874385  105.680395    .797052      7.919  .0000
(Constant)      49479.502134 2364.266709                 20.928  .0000

The following new variables are being created:

  Name        Label

  FIT_1       Fit for INSTANT from CURVEFIT, MOD_1 LINEAR
  ERR_1       Error for INSTANT from CURVEFIT, MOD_1 LINEAR
```



Graph



Curve Fit

```
MODEL:  MOD_2.
```

Dependent variable.. NUMBERS Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R .19814
R Square .03926
Adjusted R Square .01257
Standard Error 4449.77170

Analysis of Variance:

	DF	Sum of Squares	Mean Square
Regression	1	29129074.7	29129074.7
Residuals	36	712816855.2	19800468.2

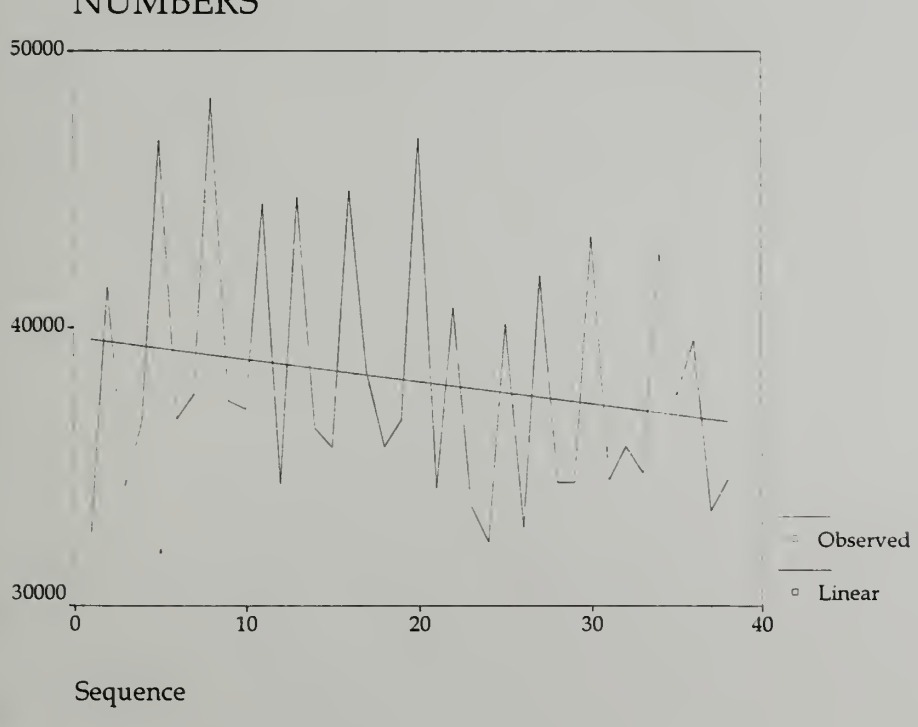
F = 1.47113 Signif F = .2331

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
Time	-79.841558	65.826898	-.198142	-1.213	.2331
(Constant)	39651.857752	1472.669966		26.925	.0000

The following new variables are being created:

Name	Label
FIT_2	Fit for NUMBERS from CURVEFIT, MOD_2 LINEAR
ERR_2	Error for NUMBERS from CURVEFIT, MOD_2 LINEAR



Curve Fit

```
MODEL:  MOD_3.
```

Dependent variable.. MASSCASH Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R	.04540
R Square	.00206
Adjusted R Square	-.05664
Standard Error	1710.35720

Analysis of Variance:

	DF	Sum of Squares	Mean Square
Regression	1	102724.7	102724.7
Residuals	17	49730469.8	2925321.8

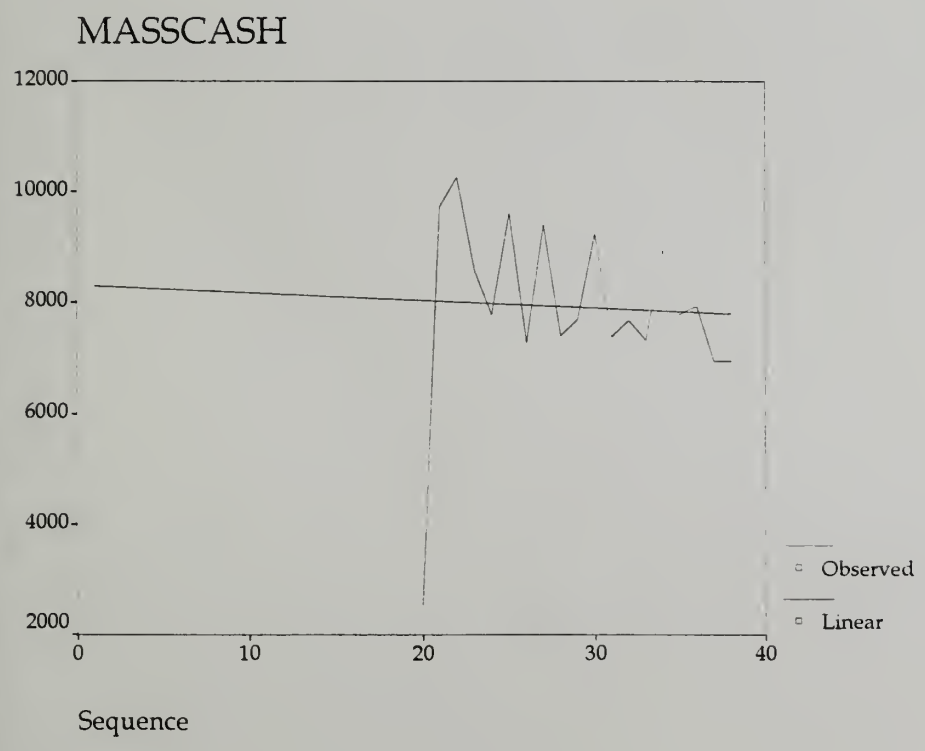
F = .03512 Signif F = .8536

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
Time	-13.424561	71.638980	-.045402	-.187	.8536
(Constant)	8304.154386	2114.260372		3.928	.0011

The following new variables are being created:

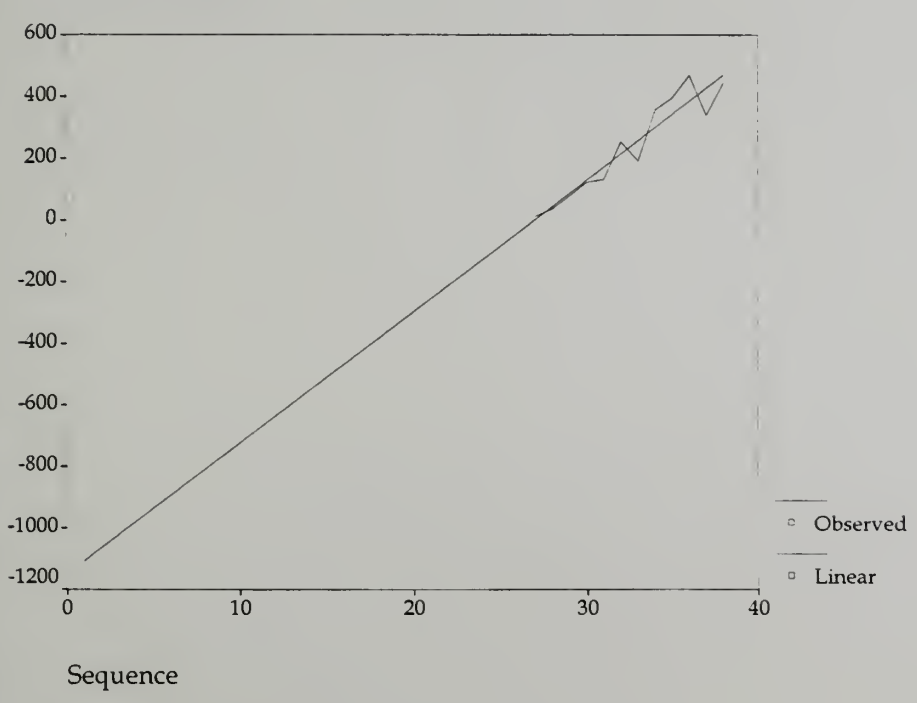
Name	Label
FIT_3	Fit for MASSCASH from CURVEFIT, MOD_3 LINEAR
ERR_3	Error for MASSCASH from CURVEFIT, MOD_3 LINEAR



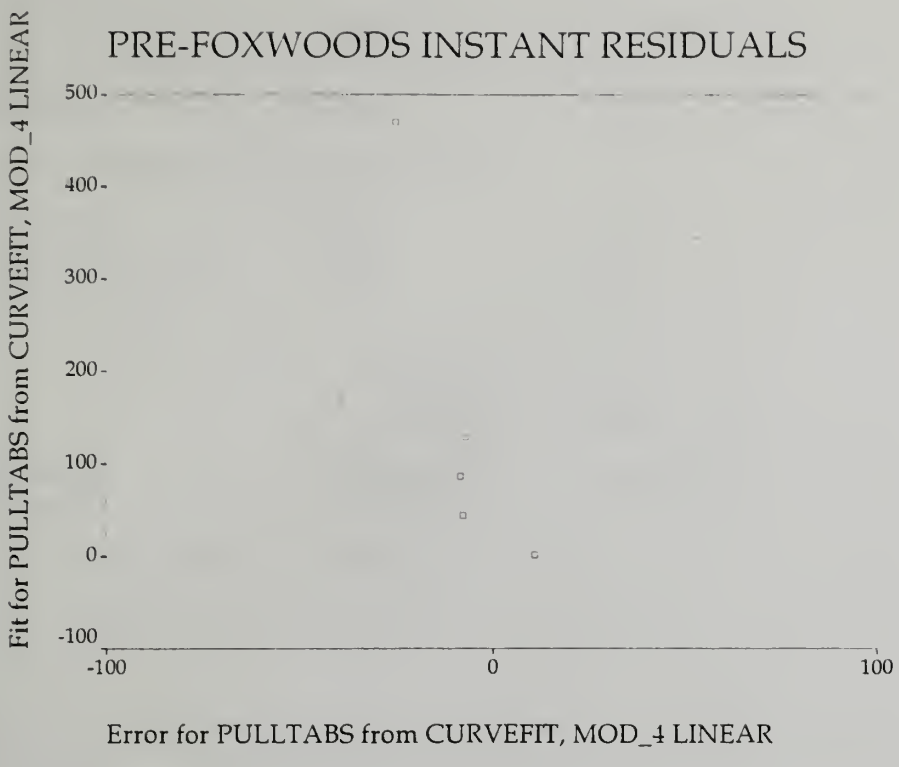
Curve Fit

MODEL: MOD_4.

```
Dependent variable.. PULLTABS          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .94782
R Square             .89836
Adjusted R Square    .88819
Standard Error     54.22881

            Analysis of Variance:

                DF    Sum of Squares      Mean Square

Regression       1         259911.27        259911.27
Residuals       10          29407.64          2940.76

F =       88.38222       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B         SE B       Beta          T  Sig T

Time                 42.632867     4.534841    .947816      9.401  .0000
(Constant)        -1149.984848   148.211395               -7.759  .0000

The following new variables are being created:

  Name        Label

  FIT_4       Fit for PULLTABS from CURVEFIT, MOD_4 LINEAR
  ERR_4       Error for PULLTABS from CURVEFIT, MOD_4 LINEAR
```



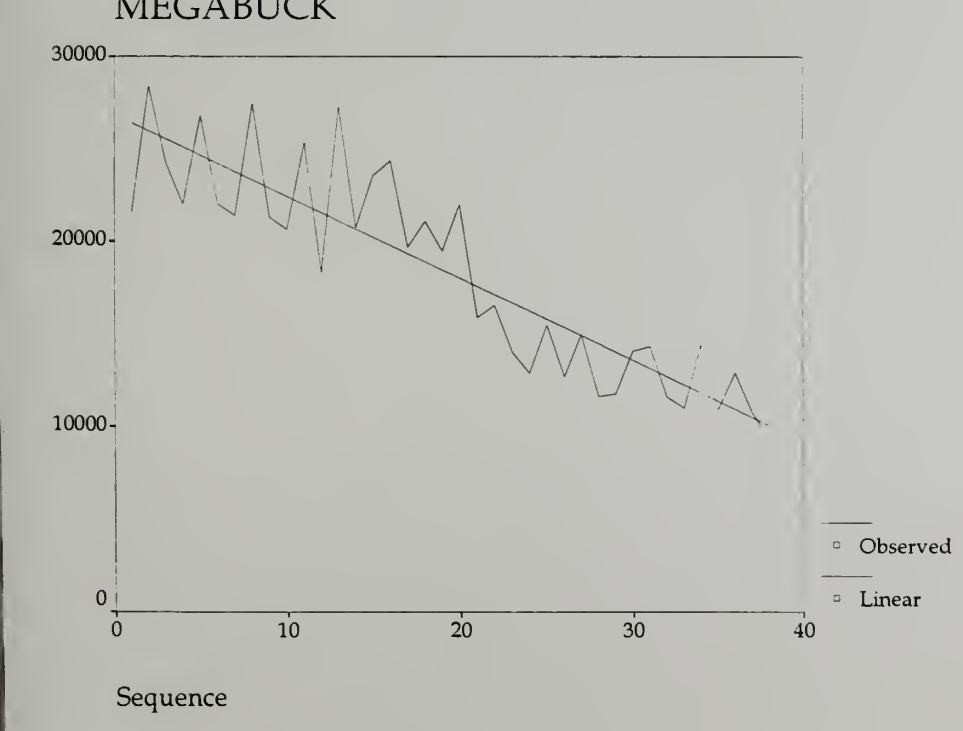
Graph



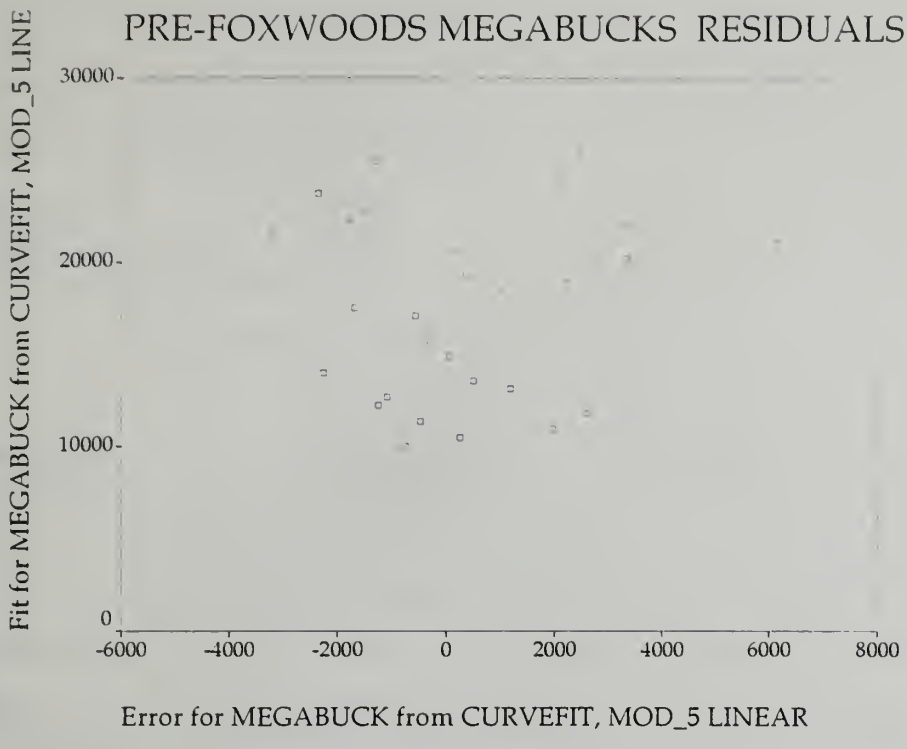
Curve Fit

```
MODEL:  MOD_5.
```

```
Dependent variable.. MEGABUCK          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .88413
R Square             .78169
Adjusted R Square    .77563
Standard Error   2631.86184

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1      892870946.7      892870946.7
Residuals      36      249361083.1        6926696.8

F =     128.90285       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta         T  Sig T

Time             -442.038407   38.933975   -.884132   -11.354  .0000
(Constant)      26827.459459  871.025335               30.800  .0000

The following new variables are being created:

  Name        Label

  FIT_5       Fit for MEGABUCK from CURVEFIT, MOD_5 LINEAR
  ERR_5       Error for MEGABUCK from CURVEFIT, MOD_5 LINEAR
```



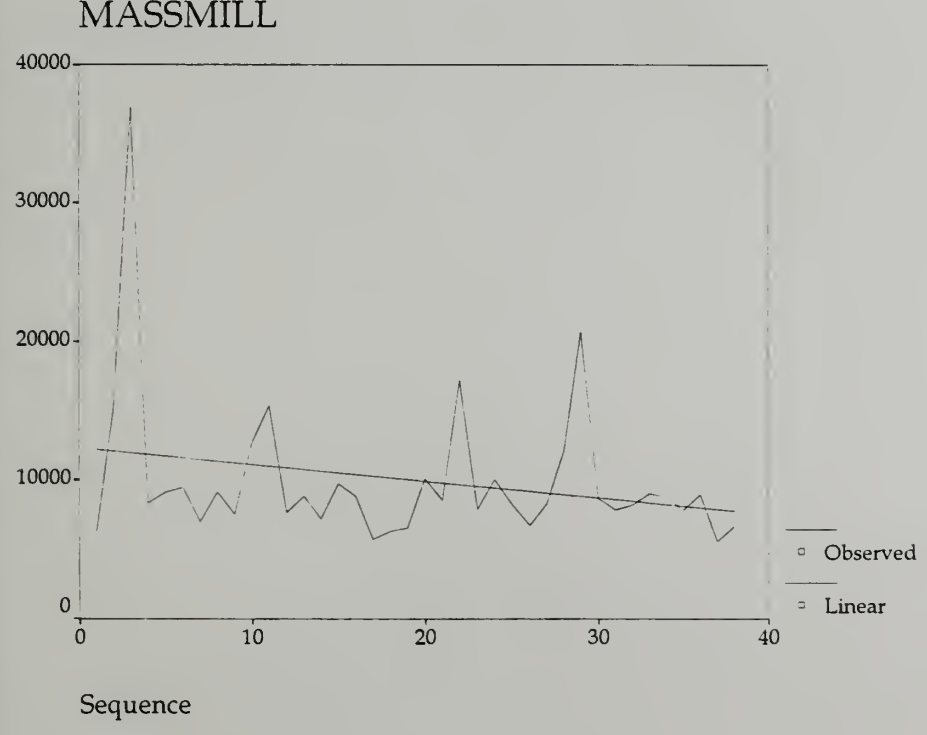
Graph



Curve Fit

```
MODEL:  MOD_6.
```

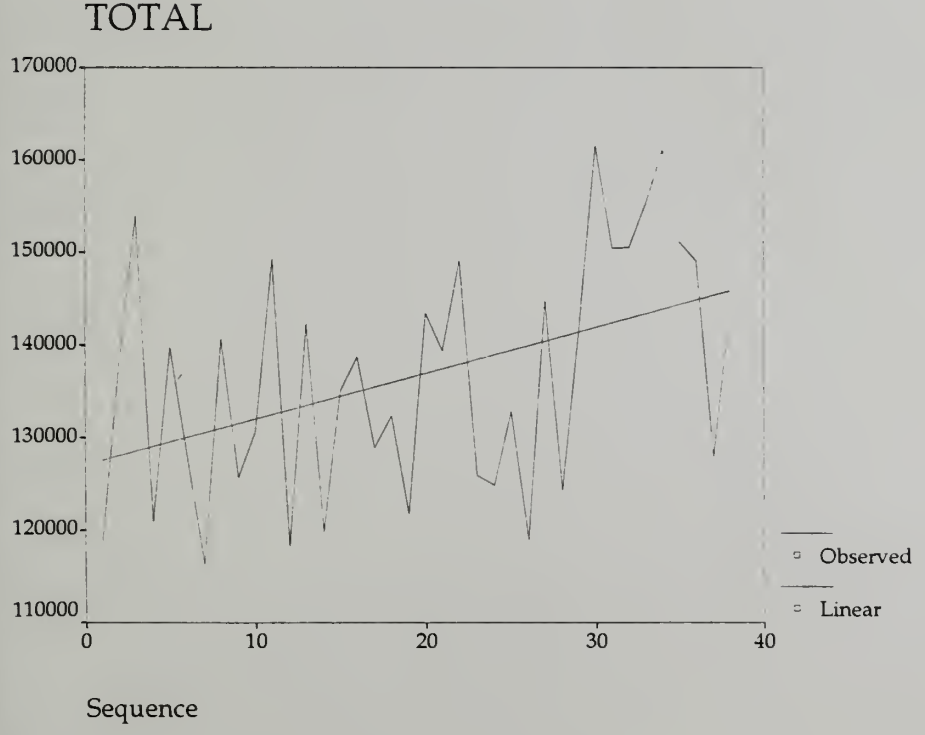
```
Dependent variable.. MASSMILL          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .24274
R Square             .05892
Adjusted R Square    .03278
Standard Error    5414.29861

            Analysis of Variance:

               DF    Sum of Squares      Mean Square

Regression      1       66075646.4       66075646.4
Residuals      36     1055326659.8       29314629.4

F =       2.25402       Signif F =  .1420

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta         T  Sig T

Time             -120.250356   80.095453   -.242739    -1.501  .1420
(Constant)     12310.566145 1791.884053                6.870  .0000

The following new variables are being created:

  Name        Label

  FIT_6       Fit for MASSMILL from CURVEFIT, MOD_6 LINEAR
  ERR_6       Error for MASSMILL from CURVEFIT, MOD_6 LINEAR
```



Curve Fit

MODEL: MOD_7.

```
Dependent variable.. TOTAL              Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .42827
R Square             .18342
Adjusted R Square    .16073
Standard Error  11779.30289

           Analysis of Variance:

               DF    Sum of Squares      Mean Square

Regression      1     1121972419.1     1121972419.1
Residuals      36     4995071153.4      138751976.5

F =       8.08617       Signif F =  .0073

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time                 495.514936  174.255000    .428273      2.844  .0073
(Constant)        127056.116643 3898.407996                32.592  .0000

The following new variables are being created:

  Name        Label

  FIT_7       Fit for TOTAL from CURVEFIT, MOD_7 LINEAR
  ERR_7       Error for TOTAL from CURVEFIT, MOD_7 LINEAR
```



Correlations

POST FOXWOODS CORRELATION COEFFICIENT MATRIX, MASSACHUSETTS STATE LOTTERY

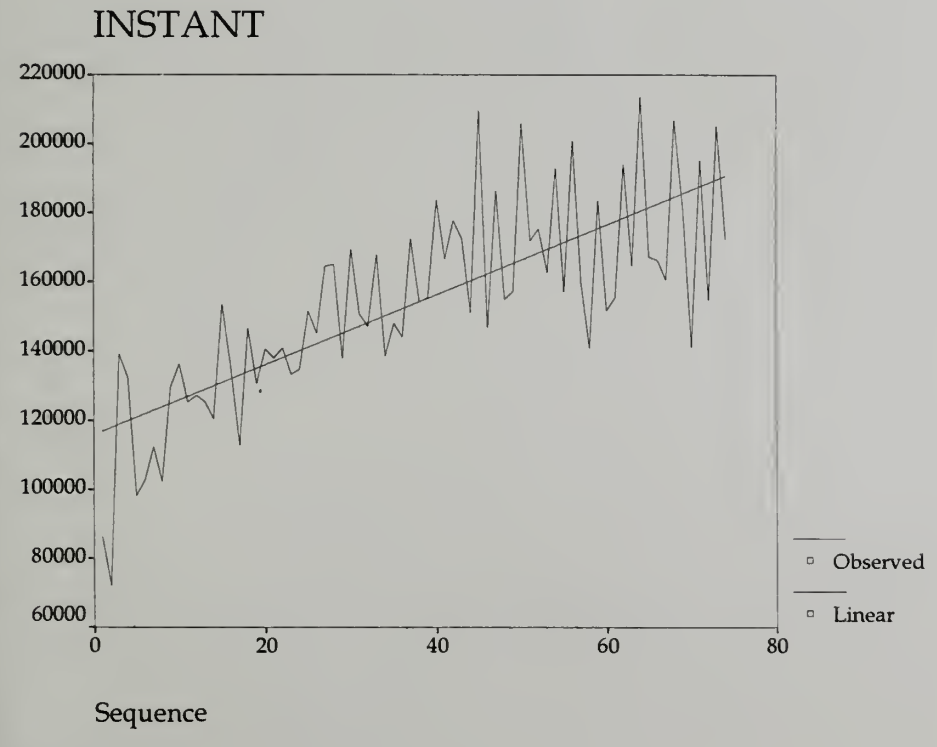
	INST	BIG	NUM	MCAS	KENO	CHAR	BEAN	PTAB	MEGA	MMIL	TOT
INST		.04	-.10	-.45**	.80**	-.14	-.32*	-.45**	-.57**	-.02	.97**
BIG	.04		.09	-.16	.17	-.27	-.26	.24	.04	.24	.18
NUM	-.10	.09		.75**	-.16	.40**	.30*	.43**	.44**	.36**	.01
MCAS	-.45**	-.16	.75**		-.58**	.52**	.35*	.67**	.79**	.43**	-.39**
KENO	.80**	.17	-.16	-.58**		-.23	-.38**	-.61**	-.71**	-.19	.81**
CHAR	-.14	-.27	.40**	.52**	-.23		.61**	.25	.47**	.12	-.08
BEAN	-.32*	-.26	.30*	.35*	-.38**	.61**		.16	.38**	.03	-.27
PTAB	-.45**	.24	.43**	.67**	-.61**	.25	.16		.67**	.41**	-.43**
MEGA	-.57**	.04	.44**	.79**	-.71**	.47**	.38**	.67**		.39**	-.51**
MMIL	-.02	.24	.36**	.43**	-.19	.12	.03	.41**	.39**		.13
TOT	.97**	.18	.01	-.39**	.81**	-.08	-.27	-.43**	-.51**	.13	

*. Correlation is significant at the 0.05 level

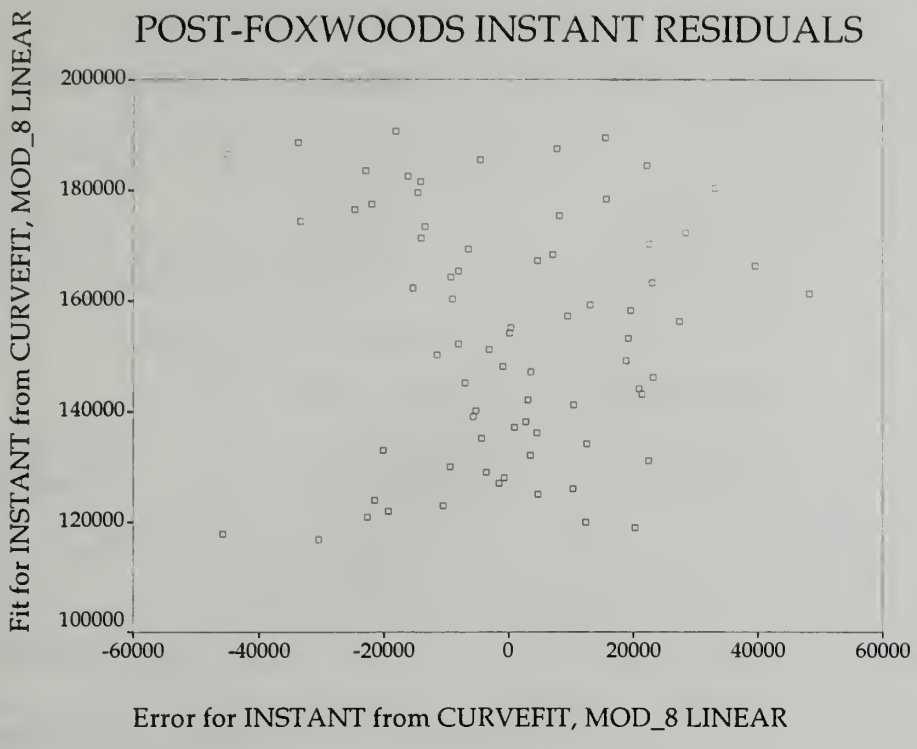
**. Correlation is significant at the 0.01 level

INST = Instant BIGA = Big Game NUMB = Numbers MCAS = Mass Cash
KENO = Keno CHAR = Charity BEAN = Beano PTAB = Pull Tabs
MEGA = Megabucks MMIL = Mass Millions TSAL = Total Sales

```
Dependent variable.. INSTANT          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .75328
R Square             .56744
Adjusted R Square    .56143
Standard Error  19101.63380

           Analysis of Variance:

              DF   Sum of Squares      Mean Square

Regression     1    34461934381.9    34461934381.9
Residuals     72    26270813785.0      364872413.7

F =      94.44927       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                   B        SE B       Beta          T  Sig T

Time            1010.305057  103.956875    .753283      9.719  .0000
(Constant)    115814.546835 4486.434761                 25.814  .0000

The following new variables are being created:

  Name        Label

  FIT_1       Fit for INSTANT from CURVEFIT, MOD_8 LINEAR
  ERR_1       Error for INSTANT from CURVEFIT, MOD_8 LINEAR
```



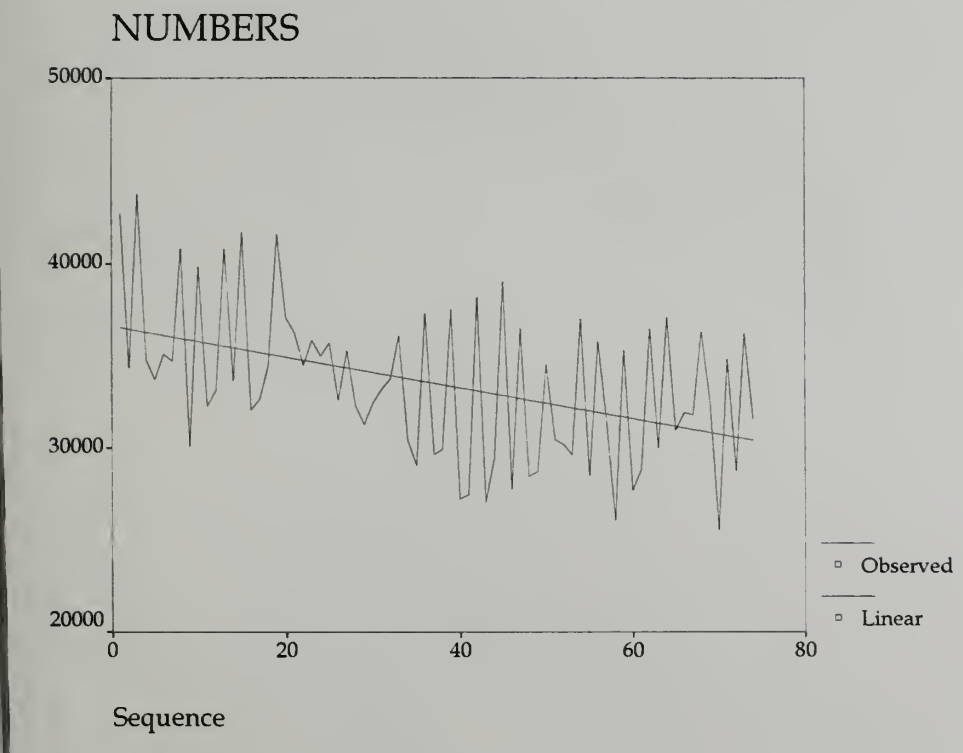
Graph



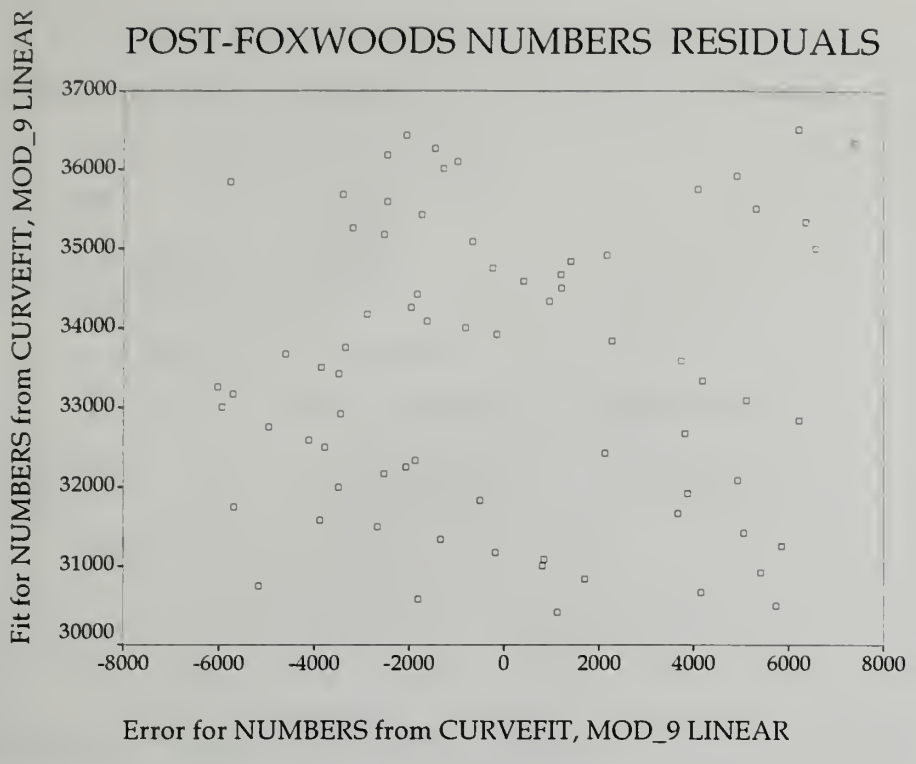
Curve Fit

```
MODEL:  MOD_9.
```

```
Dependent variable.. NUMBERS          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .43287
R Square             .18738
Adjusted R Square    .17609
Standard Error    3772.02984

           Analysis of Variance:

               DF    Sum of Squares      Mean Square

Regression      1      236216632.4      236216632.4
Residuals      72     1024431058.0       14228209.1

F =      16.60199       Signif F =  .0001

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time              -83.644606   20.528529   -.432871     -4.075  .0001
(Constant)      36603.132173  885.943370                41.315  .0000

The following new variables are being created:

  Name        Label

  FIT_2       Fit for NUMBERS from CURVEFIT, MOD_9 LINEAR
  ERR_2       Error for NUMBERS from CURVEFIT, MOD_9 LINEAR
```



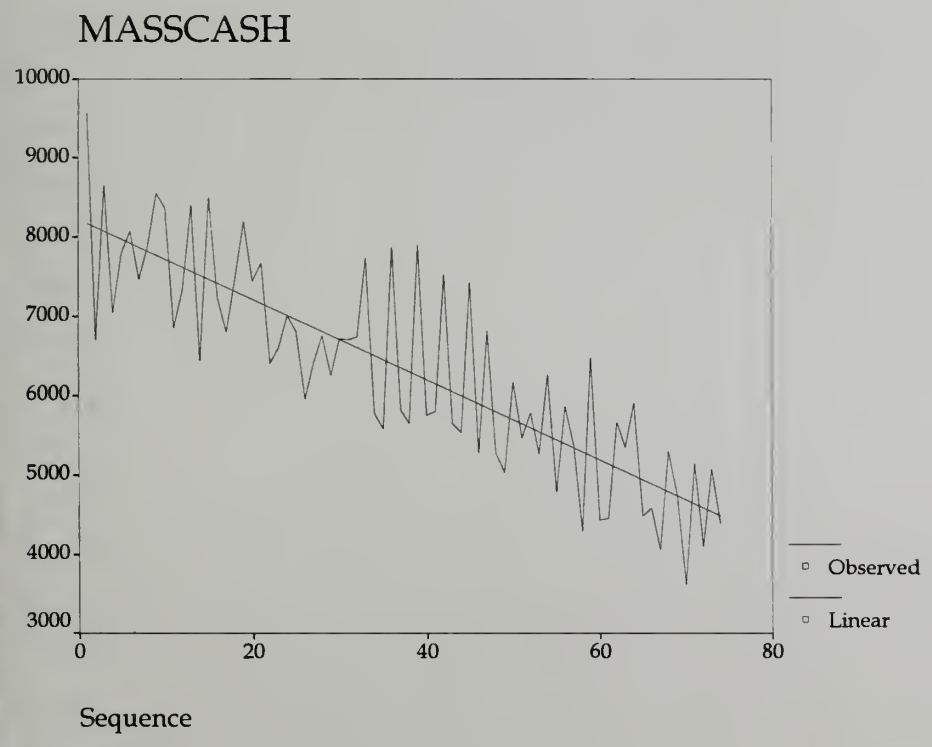
Graph



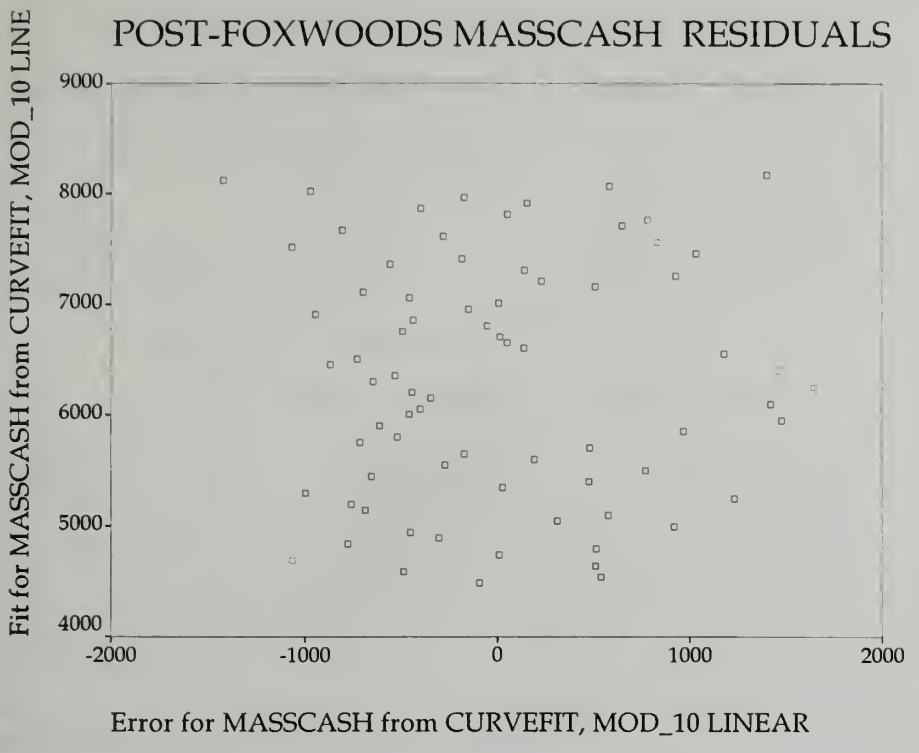
Curve Fit

```
MODEL:  MOD_10.
```

```
Dependent variable.. MASSCASH          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .83119
R Square             .69088
Adjusted R Square    .68659
Standard Error    731.20642

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1       86037910.1       86037910.1
Residuals      72       38495723.3         534662.8

F =     160.91994       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta         T  Sig T

Time              -50.480963    3.979447   -.831192   -12.685  .0000
(Constant)       8220.887449  171.739754                47.868  .0000

The following new variables are being created:

  Name        Label

  FIT_3       Fit for MASSCASH from CURVEFIT, MOD_10 LINEAR
  ERR_3       Error for MASSCASH from CURVEFIT, MOD_10 LINEAR
```



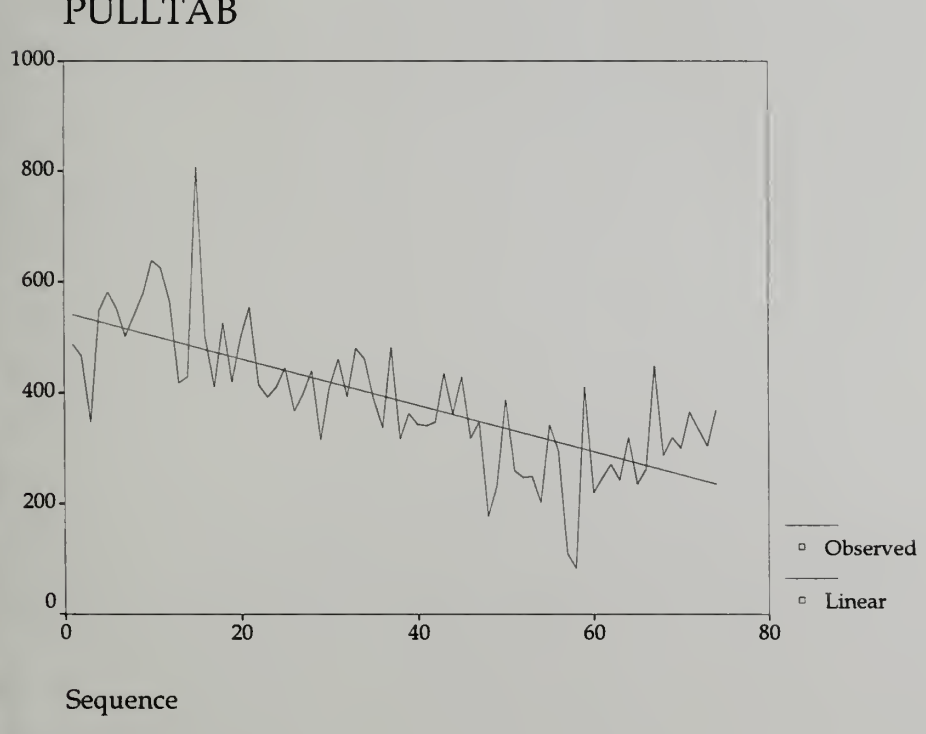
Graph



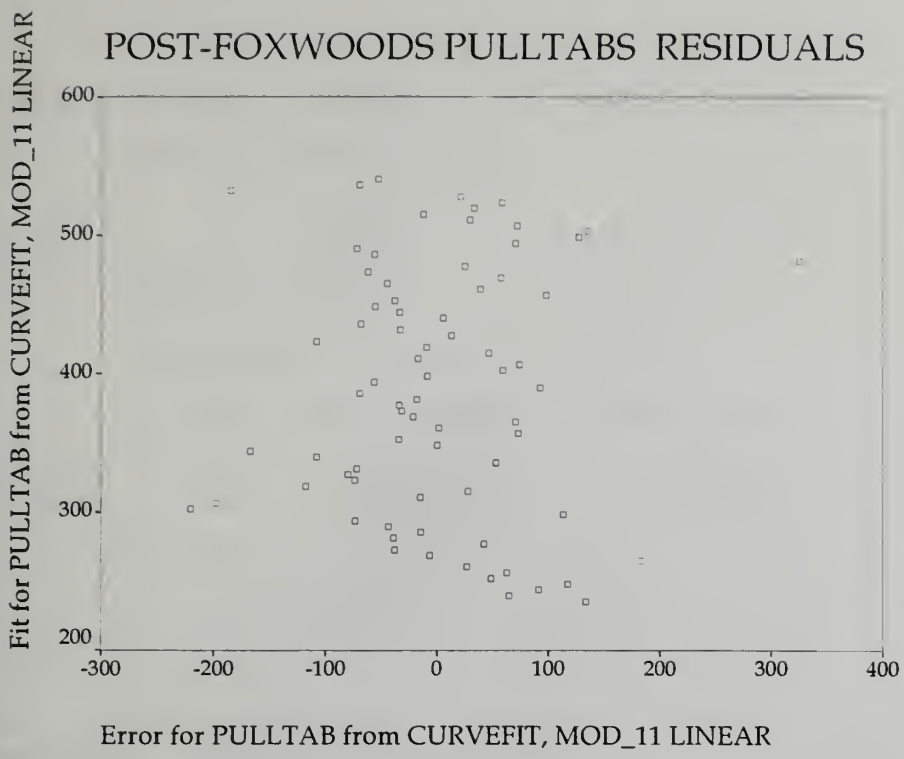
Curve Fit

```
MODEL:  MOD_11.
```

```
Dependent variable.. PULLTAB          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R            .71495
R Square              .51115
Adjusted R Square     .50436
Standard Error      88.53676

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1        590131.38        590131.38
Residuals      72        564390.53          7838.76

F =      75.28379       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time                -4.180777     .481844   -.714946     -8.677  .0000
(Constant)         544.657534   20.794786                26.192  .0000

The following new variables are being created:

  Name        Label

  FIT_4       Fit for PULLTAB from CURVEFIT, MOD_11 LINEAR
  ERR_4       Error for PULLTAB from CURVEFIT, MOD_11 LINEAR
```



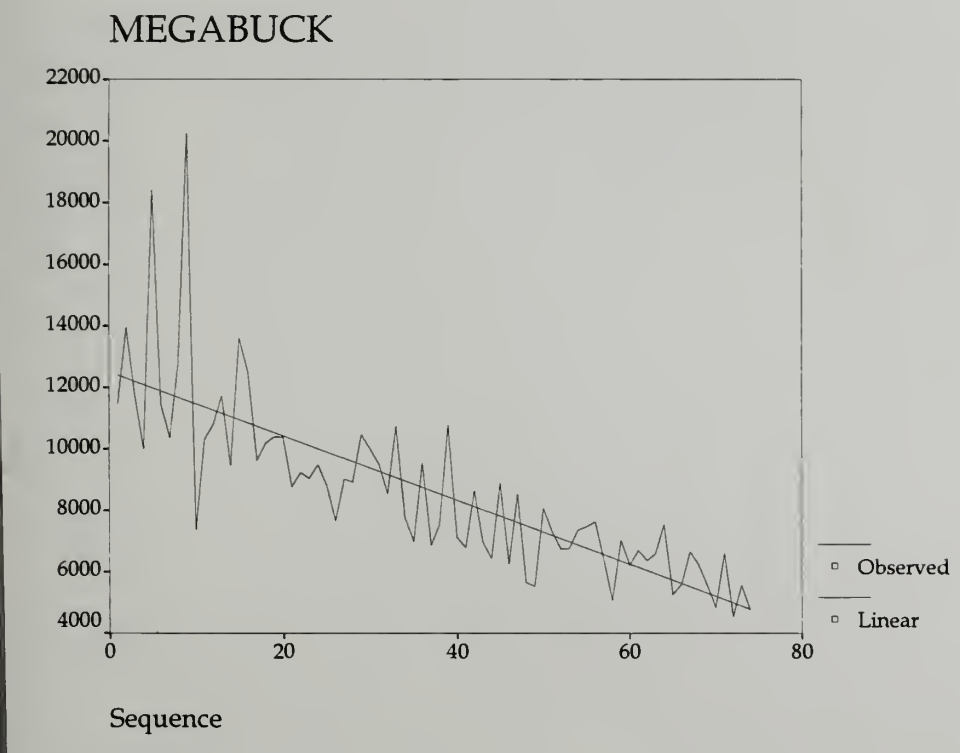
Graph



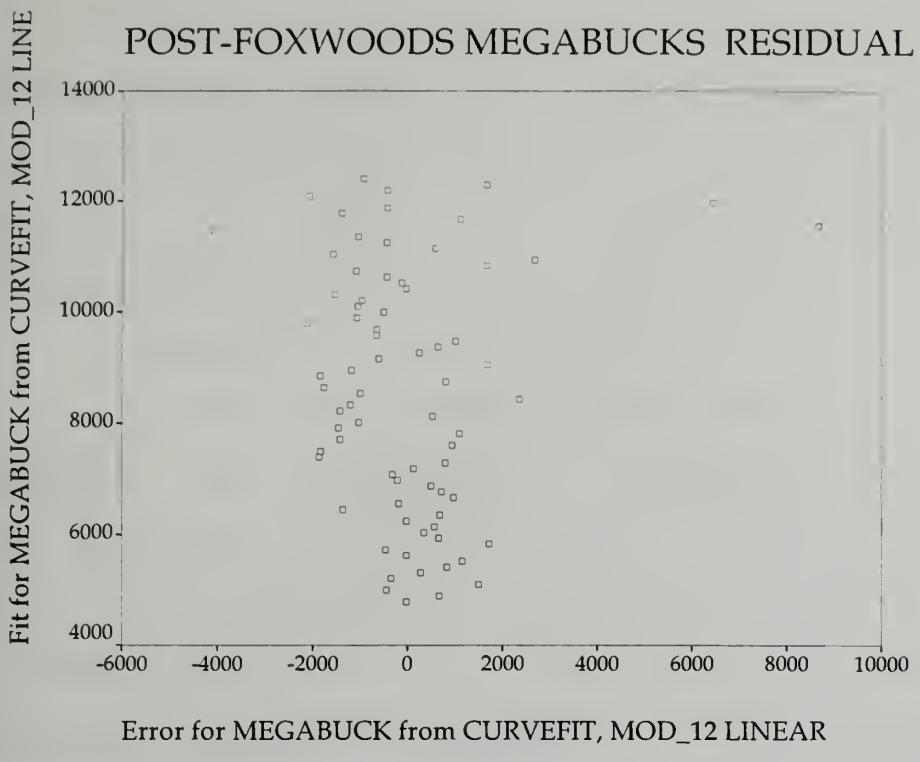
Curve Fit

```
MODEL:  MOD_12.
```

```
Dependent variable.. MEGABUCK          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .78905
R Square             .62259
Adjusted R Square    .61735
Standard Error    1760.05835

            Analysis of Variance:

                DF    Sum of Squares      Mean Square

Regression       1      367944960.2      367944960.2
Residuals       72      223041989.5        3097805.4

F =     118.77601       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time             -104.393662    9.578771   -.789046   -10.898  .0000
(Constant)      12505.519067  413.388041                30.251  .0000

The following new variables are being created:

  Name         Label

  FIT_5        Fit for MEGABUCK from CURVEFIT, MOD_12 LINEAR
  ERR_5        Error for MEGABUCK from CURVEFIT, MOD_12 LINEAR
```



Graph



Curve Fit

```
MODEL:  MOD_13.
```

Dependent variable.. MASSMILL Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R	.25923
R Square	.06720
Adjusted R Square	.05424
Standard Error	5998.75399

Analysis of Variance:

	DF	Sum of Squares	Mean Square
Regression	1	186653677.2	186653677.2
Residuals	72	2590923557.9	35985049.4

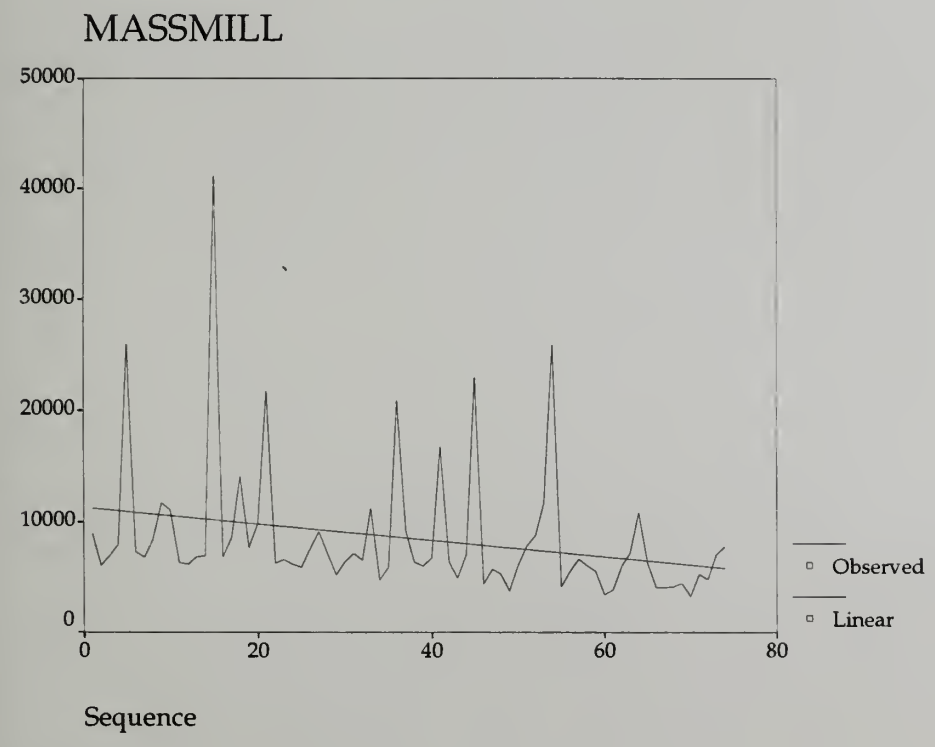
F = 5.18698 Signif F = .0257

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
Time	-74.353425	32.647036	-.259230	-2.277	.0257
(Constant)	11296.483154	1408.938037		8.018	.0000

The following new variables are being created:

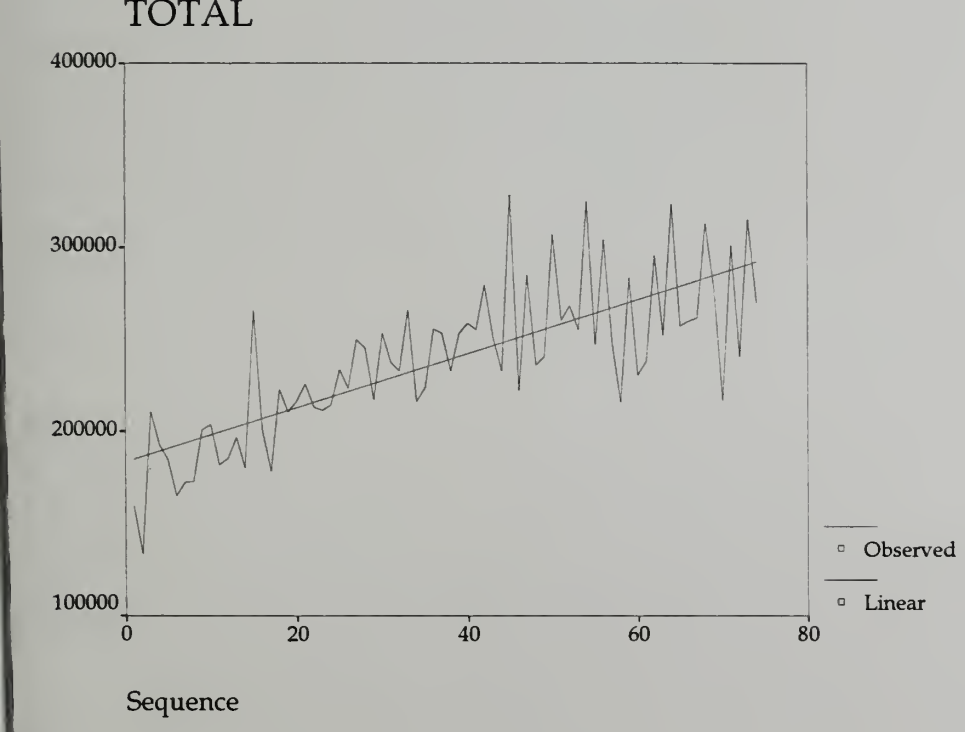
Name	Label
FIT_6	Fit for MASSMILL from CURVEFIT, MOD_13 LINEAR
ERR_6	Error for MASSMILL from CURVEFIT, MOD_13 LINEAR



Curve Fit

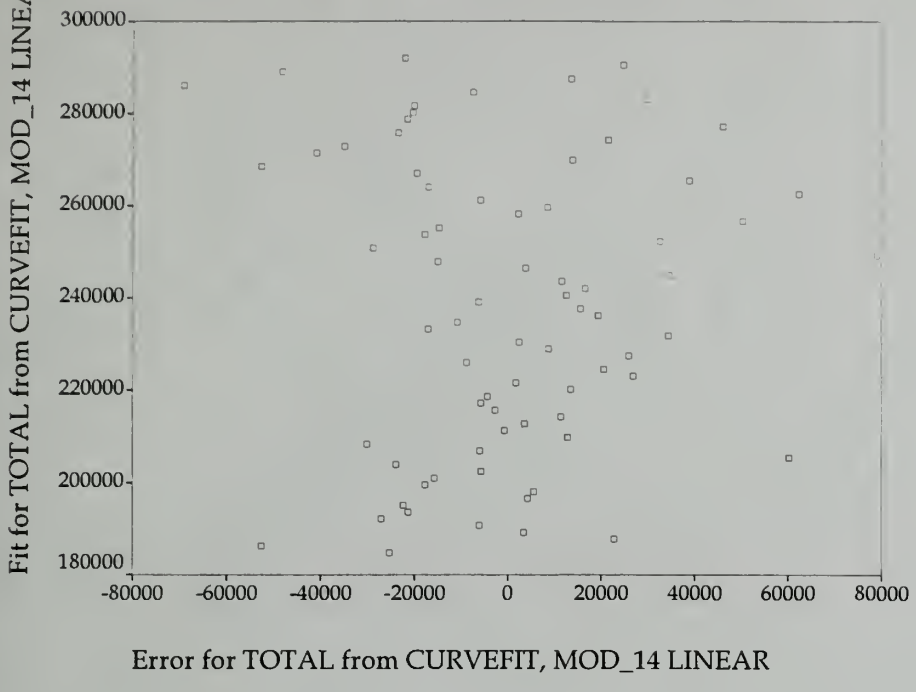
MODEL: MOD_14.

```
Dependent variable.. TOTAL            Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .75424
R Square             .56888
Adjusted R Square    .56289
Standard Error  27690.64905

           Analysis of Variance:

              DF   Sum of Squares      Mean Square

Regression     1    72849193231.3    72849193231.3
Residuals     72    55207587237.2      766772045.0

F =      95.00763       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time            1468.909619  150.700897    .754243      9.747  .0000
(Constant)    183299.402814 6503.752077                28.184  .0000

The following new variables are being created:

  Name        Label

  FIT_7       Fit for TOTAL from CURVEFIT, MOD_14 LINEAR
  ERR_7       Error for TOTAL from CURVEFIT, MOD_14 LINEAR
```



Graph

POST-FOXWOODS TOTAL SALES RESIDUA



APPENDIX F

REGRESSION ANALYSIS FOR PRE AND POST ADVERTISING BUDGET CUT (WITH CORRELATION MATRICES)

PRE ADVERTISING CUT CORRELATION COEFFICIENT MATIRX, MASSACHUSETTS STATE LOTTERY

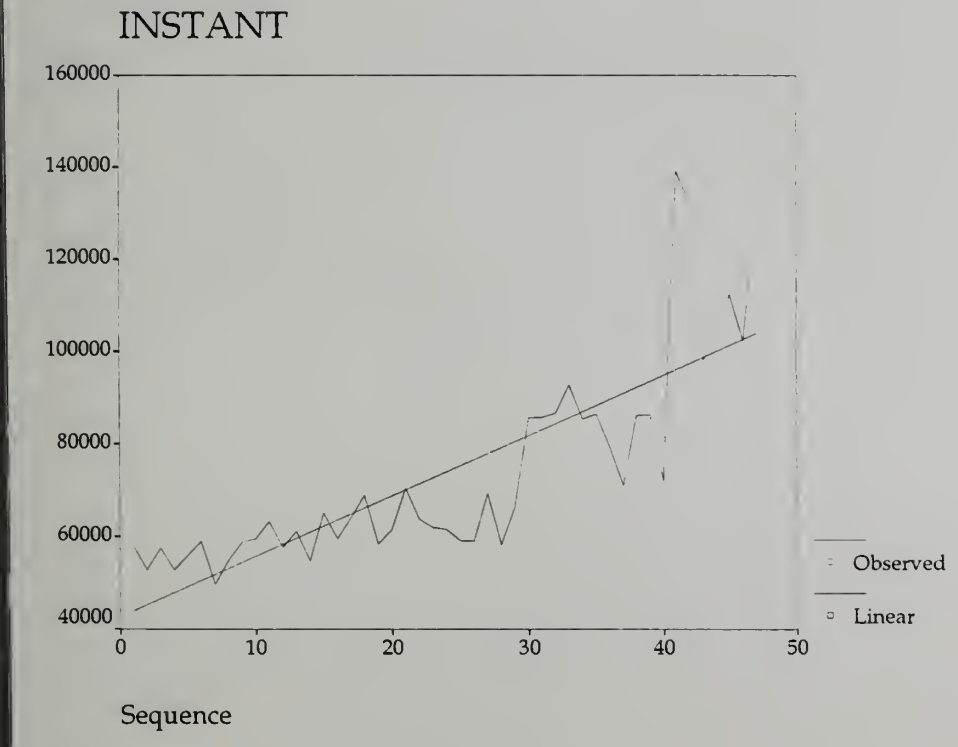
	INST	NUMB	MCAS	PTAB	MEGA	MMIL	TSAL
INST		-.01	.10	.58**	.12	-.11	.95**
NUMB	-.01		.72**	-.18	-.11	-.25	.12
MCAS	.10	.72**		-.14	.37	.05	.30
PTAB	.58**	-.18	-.14		.11	-.03	.53*
MEGA	.12	-.11	.37	.11		.47*	.33
MMIL	-.11	-.25	.05	-.03	.47*		.13
TSAL	.95**	.12	.30	.53*	.33	.13	

*. Correlation is significant at the 0.05 level

**. Correlation is significant at the 0.01 level

INST = Instant NUMB = Numbers MCAS = Mass Cash PTAB = Pull Tabs
MEGA = Megabucks MMIL = Mass Millions TSAL = Total Sales

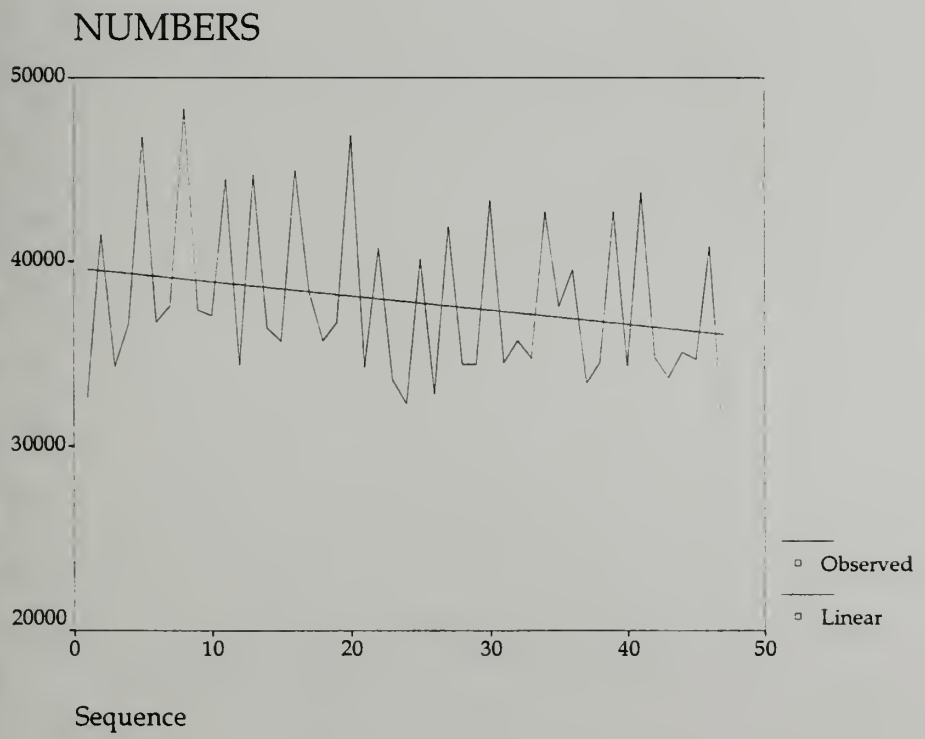
```
Dependent variable.. INSTANT          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .81475
R Square             .66382
Adjusted R Square    .65635
Standard Error  12859.95138

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1    14695161089.1    14695161089.1
Residuals      45     7442025729.8      165378349.6

F =      88.85783       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time            1303.554926  138.287042    .814753      9.426  .0000
(Constant)     42652.426457 3812.310650                 11.188  .0000

The following new variables are being created:

  Name        Label

  FIT_1       Fit for INSTANT from CURVEFIT, MOD_8 LINEAR
  ERR_1       Error for INSTANT from CURVEFIT, MOD_8 LINEAR
```



Curve Fit

```
MODEL:  MOD_9.
```

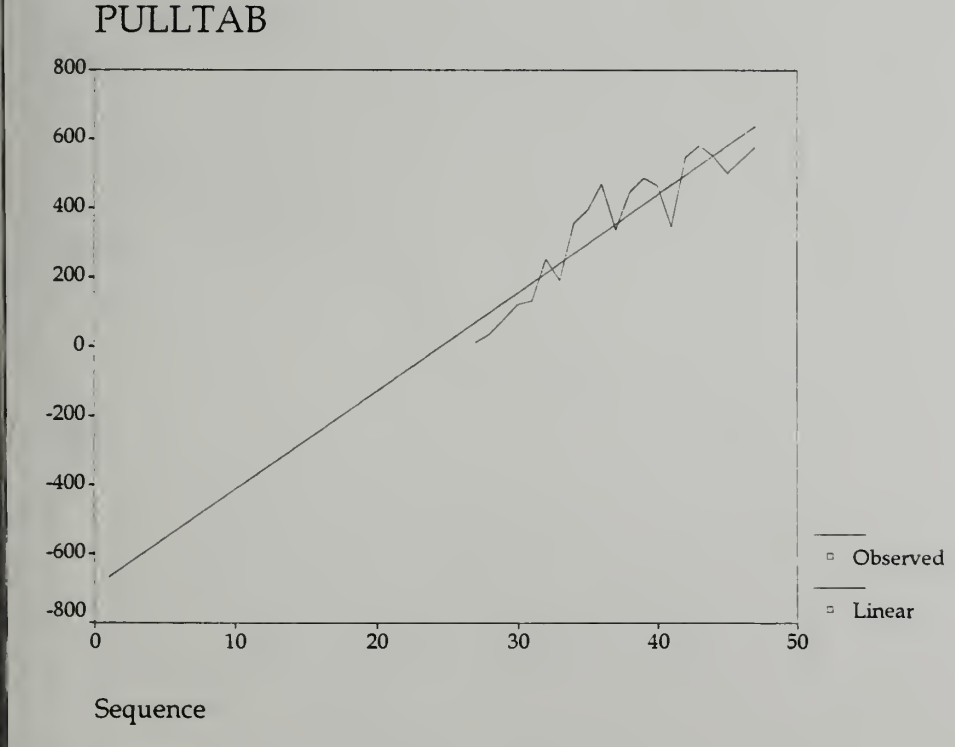
```
Dependent variable.. NUMBERS          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .23198
R Square             .05381
Adjusted R Square    .03279
Standard Error   4417.32808

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1       49940208.6       49940208.6
Residuals      45      878075429.6       19512787.3

F =       2.55936       Signif F =  .1166

------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta         T  Sig T

Time              -75.991906   47.500897   -.231978    -1.600  .1166
(Constant)      39646.124884 1309.509373               30.276  .0000

The following new variables are being created:

  Name        Label

  FIT_2       Fit for NUMBERS from CURVEFIT, MOD_9 LINEAR
  ERR_2       Error for NUMBERS from CURVEFIT, MOD_9 LINEAR
```



Curve Fit

```
MODEL:  MOD_10.
```

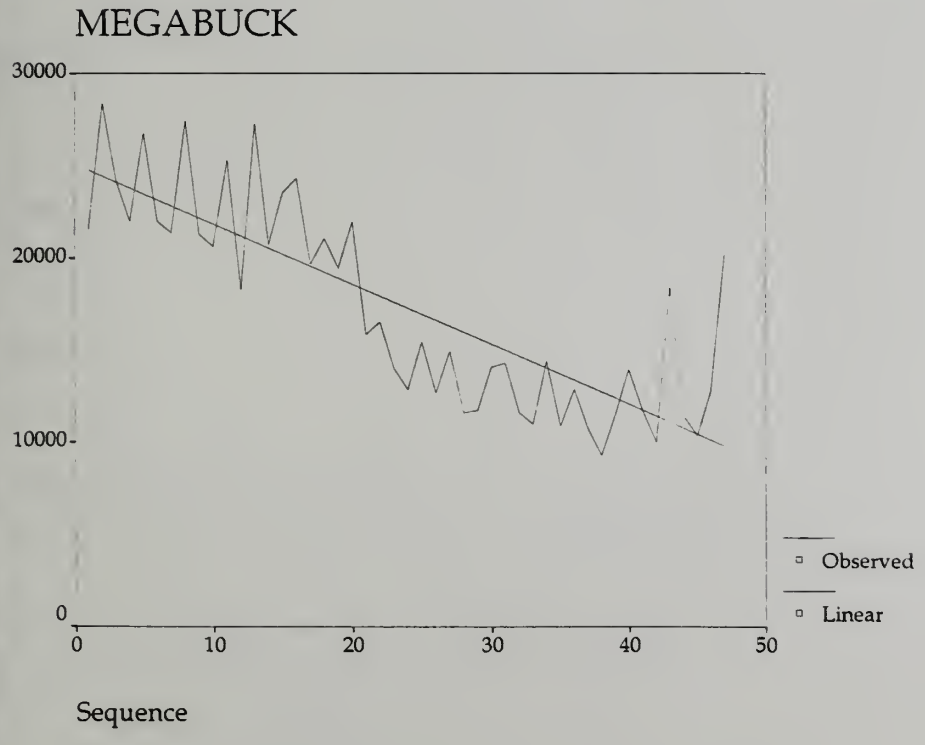
```
Dependent variable.. PULLTAB          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .92742
R Square             .86012
Adjusted R Square    .85275
Standard Error     72.95437

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1        621789.82        621789.82
Residuals      19        101124.47          5322.34

F =     116.82639       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time                 28.416883    2.629093    .927424    10.809  .0000
(Constant)         -697.710390   98.570539                -7.078  .0000

The following new variables are being created:

  Name        Label

  FIT_3       Fit for PULLTAB from CURVEFIT, MOD_10 LINEAR
  ERR_3       Error for PULLTAB from CURVEFIT, MOD_10 LINEAR
```



Curve Fit

```
MODEL:  MOD_11.
```

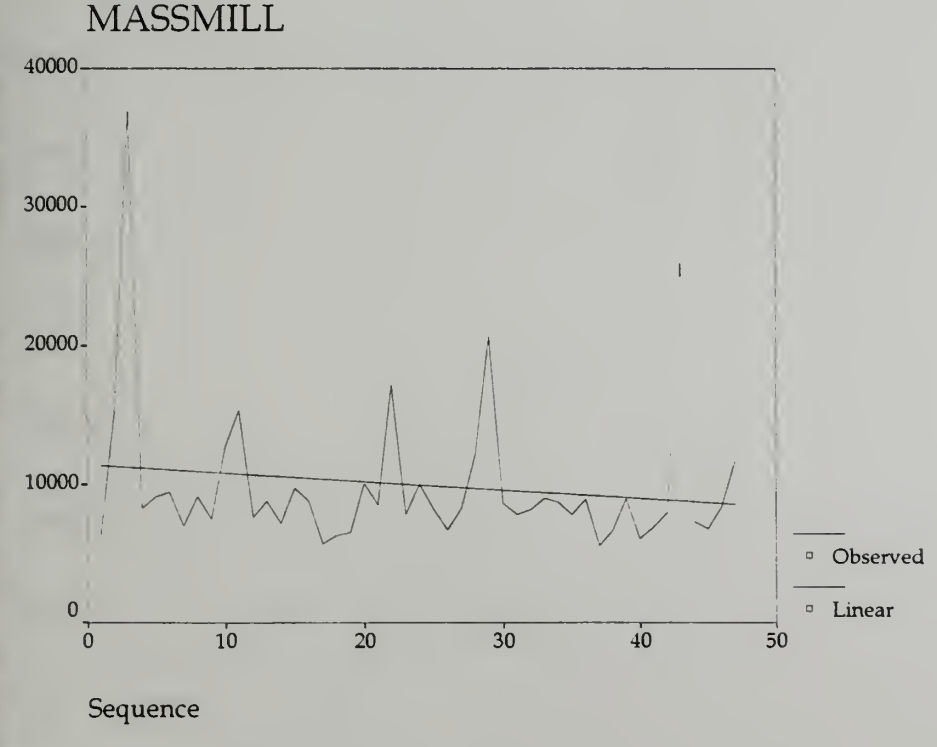
```
Dependent variable.. MEGABUCK          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .80491
R Square             .64789
Adjusted R Square    .64006
Standard Error    3328.60813

            Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1      917384338.1      917384338.1
Residuals      45      498583444.8       11079632.1

F =      82.79917       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta         T  Sig T

Time             -325.700046   35.793555   -.804913    -9.099  .0000
(Constant)     25098.439408  986.760203               25.435  .0000

The following new variables are being created:

  Name        Label

  FIT_4       Fit for MEGABUCK from CURVEFIT, MOD_11 LINEAR
  ERR_4       Error for MEGABUCK from CURVEFIT, MOD_11 LINEAR
```



Curve Fit

```
MODEL:  MOD_12.
```

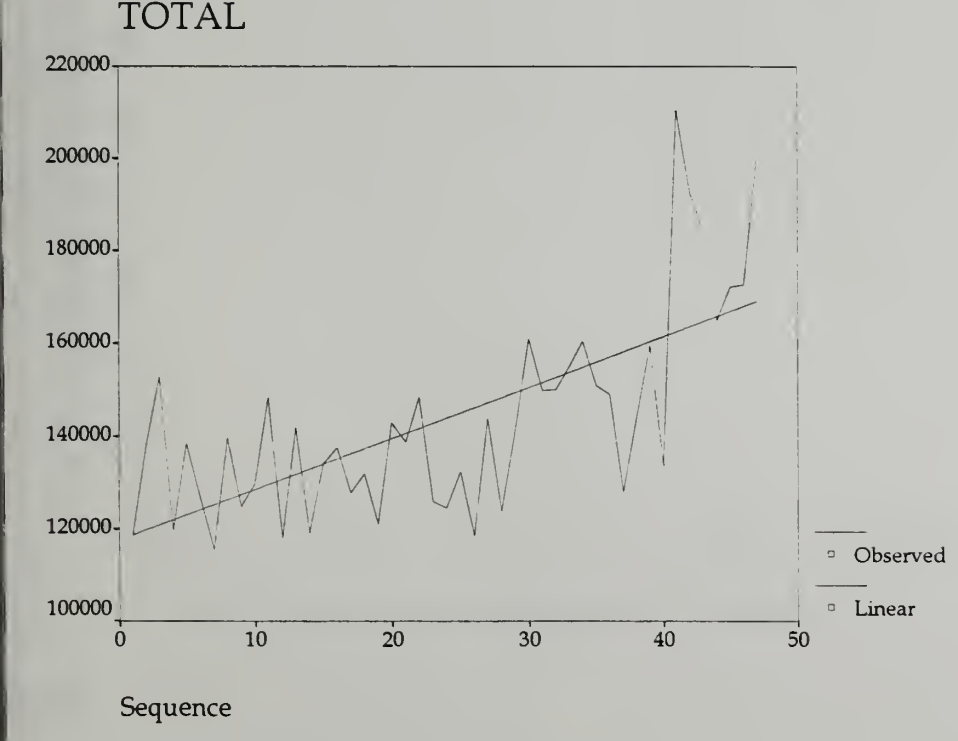
```
Dependent variable.. MASSMILL          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .14957
R Square             .02237
Adjusted R Square    .00065
Standard Error   5571.03381

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1       31960347.4       31960347.4
Residuals      45     1396638796.3       31036417.7

F =       1.02977       Signif F =  .3156

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta         T  Sig T

Time              -60.792206   59.907053   -.149572    -1.015  .3156
(Constant)      11432.502313 1651.523469                6.922  .0000

The following new variables are being created:

  Name        Label

  FIT_5       Fit for MASSMILL from CURVEFIT, MOD_12 LINEAR
  ERR_5       Error for MASSMILL from CURVEFIT, MOD_12 LINEAR
```



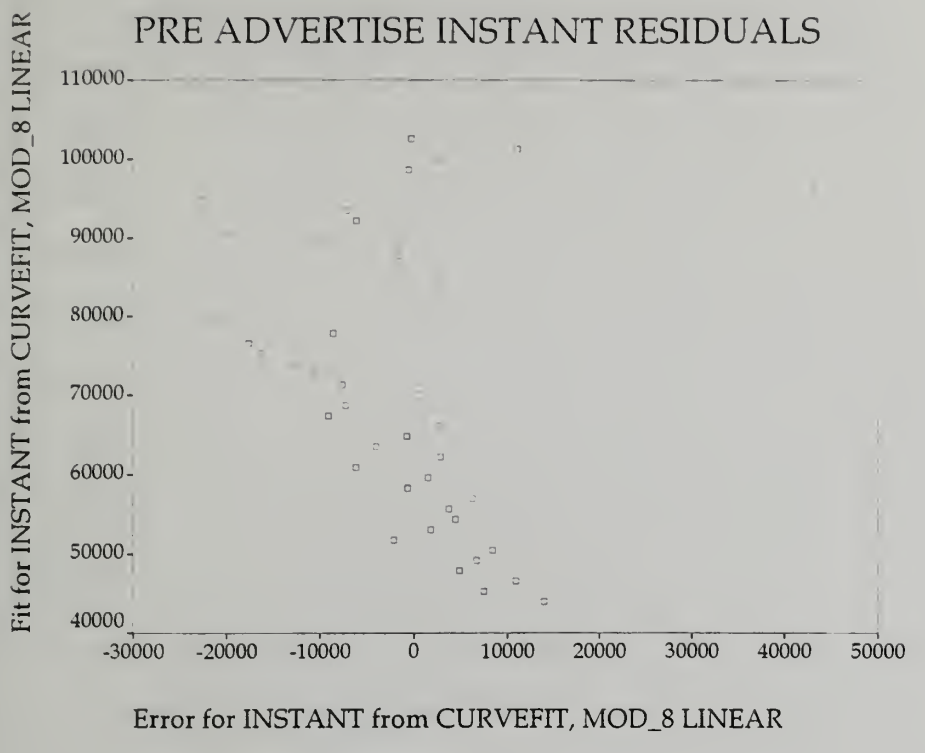
Curve Fit

```
MODEL:  MOD_13.
```

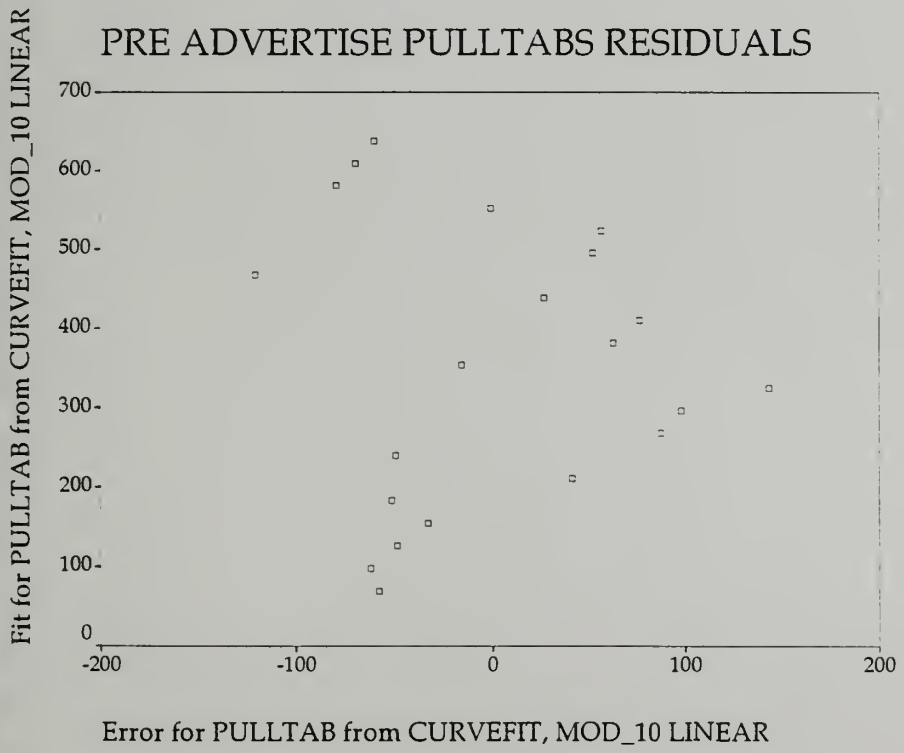
```
Dependent variable.. TOTAL            Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .67970
R Square             .46200
Adjusted R Square    .45004
Standard Error  16428.21756

           Analysis of Variance:

              DF   Sum of Squares      Mean Square

Regression     1    10429065540.1    10429065540.1
Residuals     45    12144884950.8      269886332.2

F =      38.64244       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                   B        SE B       Beta          T  Sig T

Time            1098.158071  176.657714    .679703      6.216  .0000
(Constant)    117542.844588 4870.117072                24.136  .0000

The following new variables are being created:

  Name        Label

  FIT_6       Fit for TOTAL from CURVEFIT, MOD_13 LINEAR
  ERR_6       Error for TOTAL from CURVEFIT, MOD_13 LINEAR
```



Graph

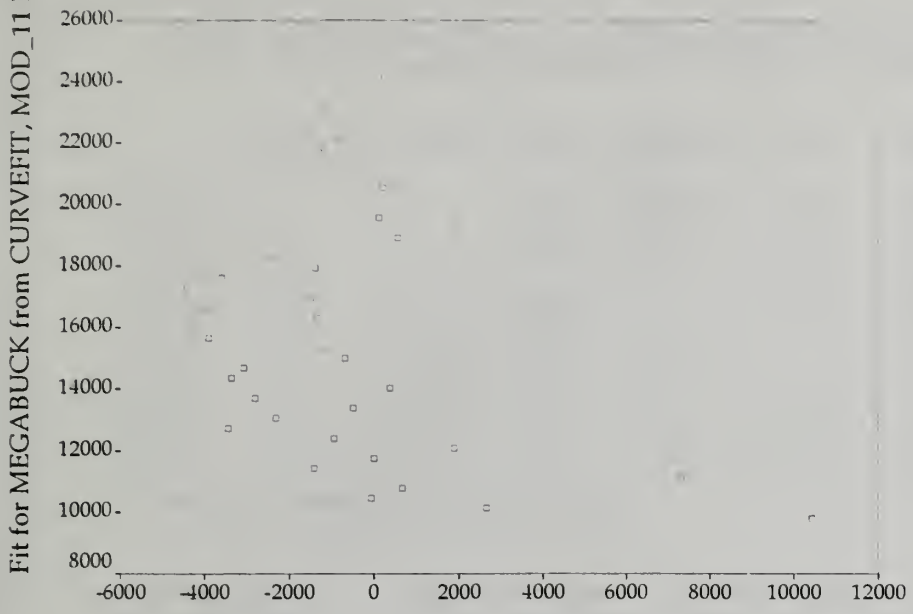

PRE ADVERTISE INSTANT RESIDUALS
Fit for INSTANT from CURVEFIT, MOD_8 LINEAR
110000
100000
90000
80000
70000
60000
50000
40000
-30000
-20000
-10000
0
10000
20000
30000
40000
50000
Error for INSTANT from CURVEFIT, MOD_8 LINEAR

Graph


PRE ADVERTISE PULLTABS RESIDUALS
Fit for PULLTAB from CURVEFIT, MOD_10 LINEAR
700
600
500
400
300
200
100
0
-200
-100
0
100
200
Error for PULLTAB from CURVEFIT, MOD_10 LINEAR

Graph

PRE ADVERTISE MEGABUCKS RESIDUALS



POST ADVERTISING CUT CORRELATION COEFFICIENT MATRIX, MASSACHUSETTS STATE LOTTERY

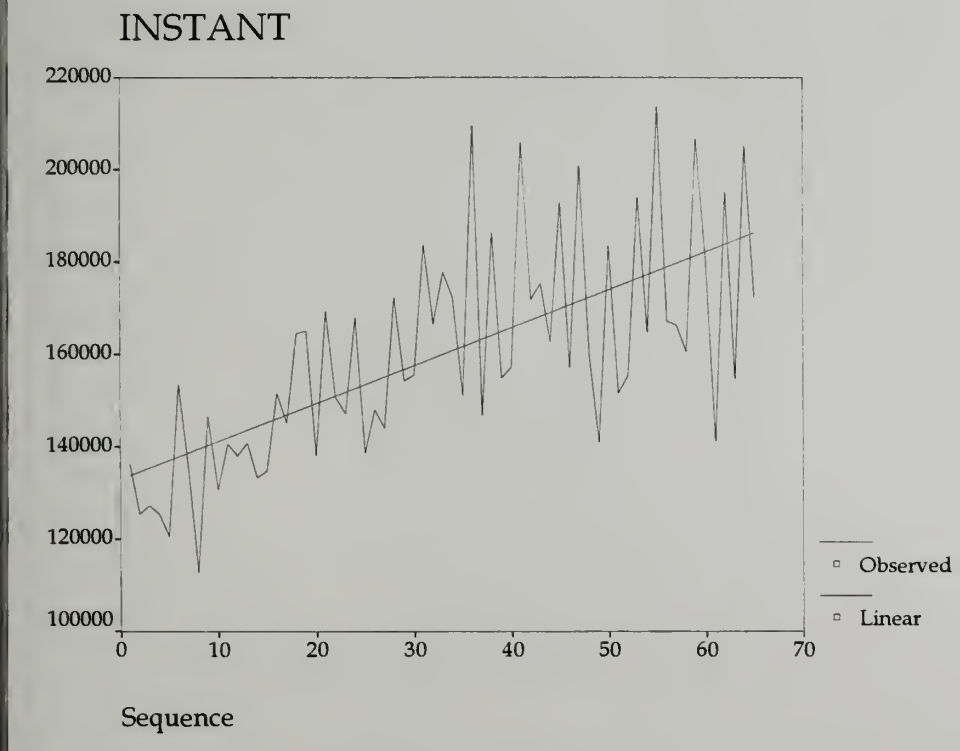
	INST	NUMB	MCAS	KENO	PTAB	MEGA	MMIL	TSAL
INST		.14	-.25*	.80**	-.30*	-.40**	.07	.97**
NUMB	.14		.74**	-.16	.42**	.61**	.45**	.27*
MCAS	-.25*	.74**		-.58**	.63**	.90**	.48**	-.17
KENO	.80**	-.16	-.58**		-.61**	-.71**	-.19	.81**
PTAB	-.30*	.42**	.63**	-.61**		.71**	.41**	-.27*
MEGA	-.40**	.61**	.90**	-.71**	.71**		.40**	-.34**
MMIL	.71	.45**	.48**	-.19	.41**	.40**		.23
TSAL	.97**	.27*	-.17	.81**	-.27*	-.34**	.23	

*. Correlation is significant at the 0.05 level

**. Correlation is significant at the 0.01 level

INST = Instant NUMB = Numbers MCAS = Mass Cash KENO = Keno
PTAB = Pull Tabs MEGA = Megabucks MMIL = Mass Millions TSAL = Total Sales

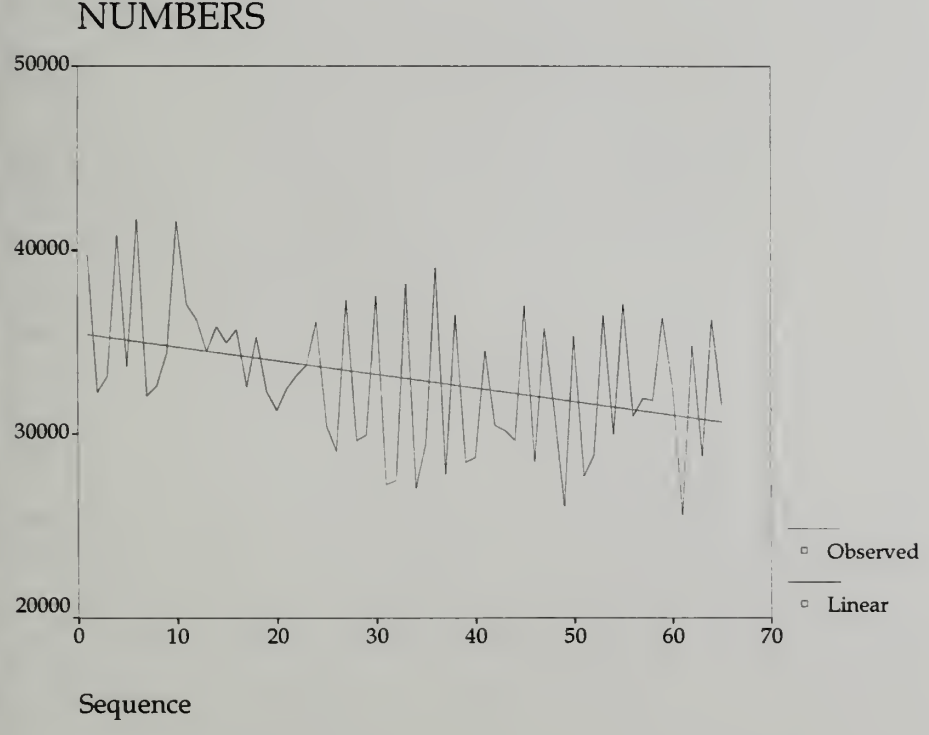
```
Dependent variable.. INSTANT          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .65858
R Square             .43372
Adjusted R Square    .42474
Standard Error  17903.96721

           Analysis of Variance:

               DF    Sum of Squares      Mean Square

Regression      1    15467644081.2    15467644081.2
Residuals      63    20194778648.0      320552042.0

F =      48.25314       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time              822.212500  118.364444    .658577      6.946  .0000
(Constant)     132853.818269 4493.174177                29.568  .0000

The following new variables are being created:

  Name        Label

  FIT_1       Fit for INSTANT from CURVEFIT, MOD_1 LINEAR
  ERR_1       Error for INSTANT from CURVEFIT, MOD_1 LINEAR
```



Curve Fit

```
MODEL:  MOD_2.
```

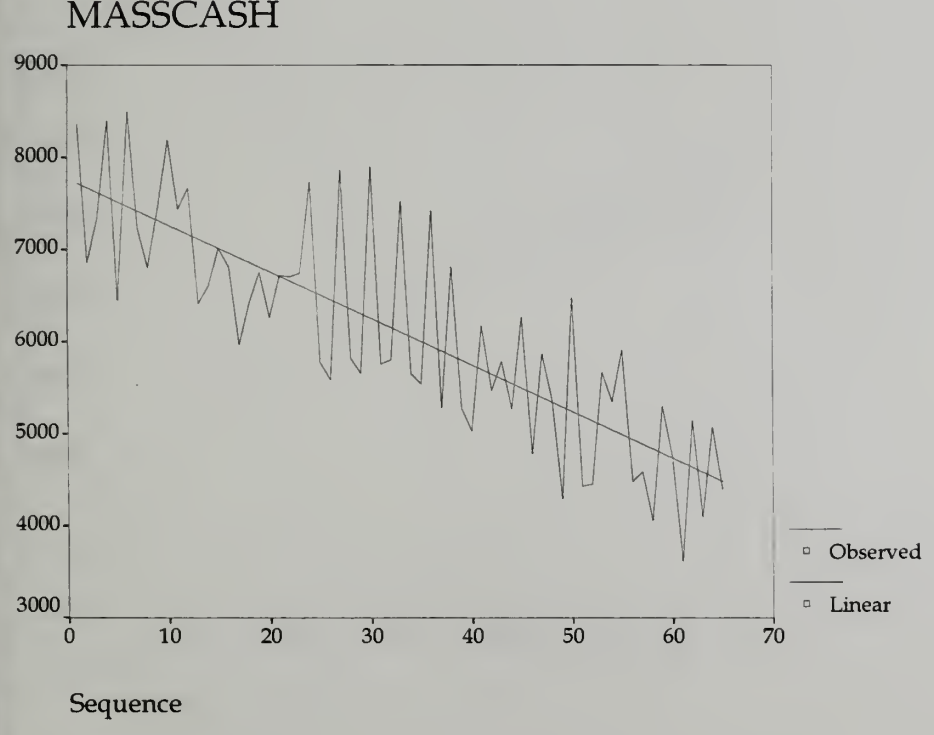
```
Dependent variable.. NUMBERS          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .35995
R Square             .12956
Adjusted R Square    .11574
Standard Error   3687.37575

           Analysis of Variance:

              DF   Sum of Squares      Mean Square

Regression     1      127499811.2      127499811.2
Residuals     63      856594613.8       13596739.9

F =       9.37723       Signif F =  .0032

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta         T  Sig T

Time              -74.649476   24.377512   -.359945    -3.062  .0032
(Constant)      35486.155769  925.382698               38.348  .0000

The following new variables are being created:

  Name        Label

  FIT_2       Fit for NUMBERS from CURVEFIT, MOD_2 LINEAR
  ERR_2       Error for NUMBERS from CURVEFIT, MOD_2 LINEAR
```



Curve Fit

```
MODEL:  MOD_3.
```

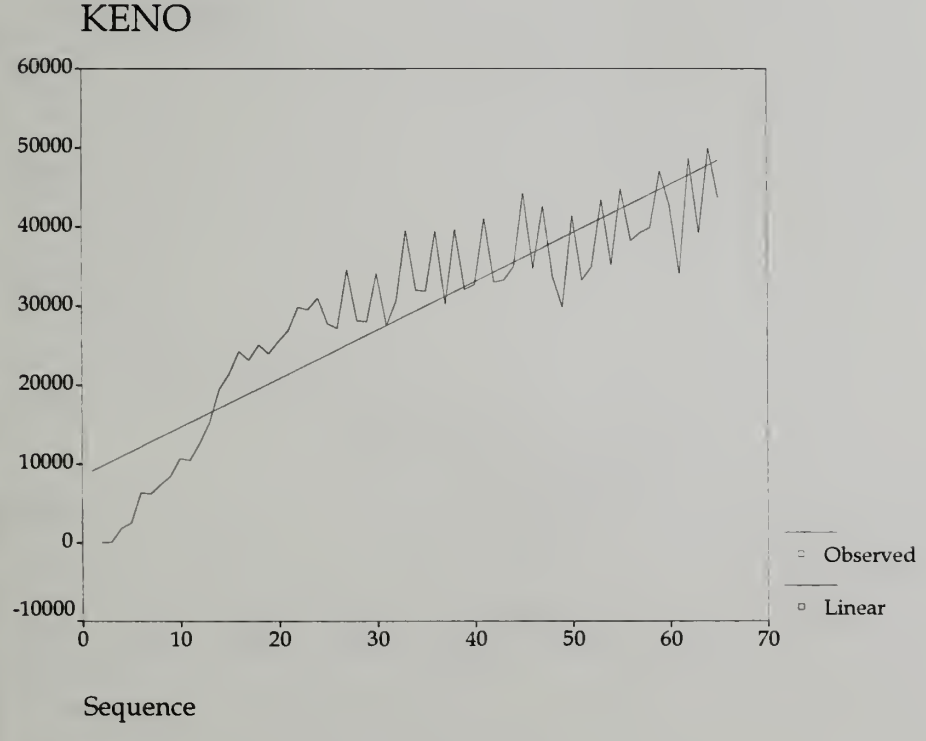
```
Dependent variable.. MASSCASH          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R            .80201
R Square              .64322
Adjusted R Square     .63755
Standard Error     717.26209

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1       58431963.0       58431963.0
Residuals      63       32411289.1         514464.9

F =     113.57813       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B         SE B       Beta          T  Sig T

Time              -50.535577     4.741872   -.802008   -10.657  .0000
(Constant)       7768.427885   180.003876                43.157  .0000

The following new variables are being created:

  Name        Label

  FIT_3       Fit for MASSCASH from CURVEFIT, MOD_3 LINEAR
  ERR_3       Error for MASSCASH from CURVEFIT, MOD_3 LINEAR
```



Curve Fit

```
MODEL:  MOD_4.
```

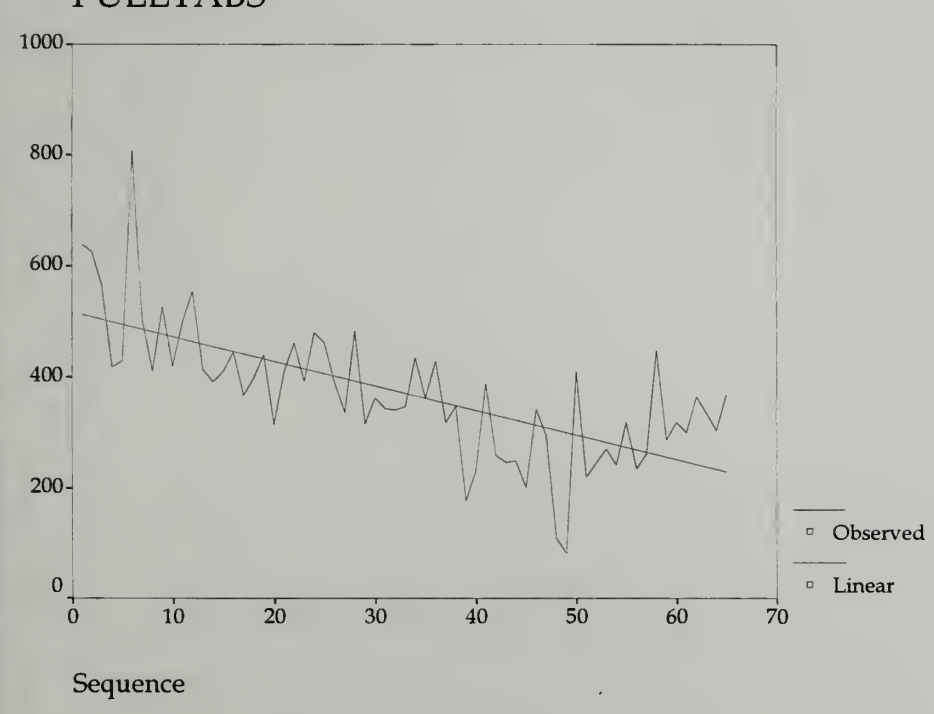
```
Dependent variable.. KENO              Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .89587
R Square             .80259
Adjusted R Square    .79941
Standard Error   5724.24065

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1     8259520135.3     8259520135.3
Residuals      62     2031549726.5       32766931.1

F =     252.06877       Signif F =  .0000

------------------- Variables in the Equation --------------------

Variable                   B        SE B       Beta          T  Sig T

Time             614.965980   38.733930    .895874    15.877  .0000
(Constant)      8478.327175 1481.794335                5.722  .0000

The following new variables are being created:

  Name        Label

  FIT_4       Fit for KENO from CURVEFIT, MOD_4 LINEAR
  ERR_4       Error for KENO from CURVEFIT, MOD_4 LINEAR
```



Curve Fit

```
MODEL:  MOD_5.
```

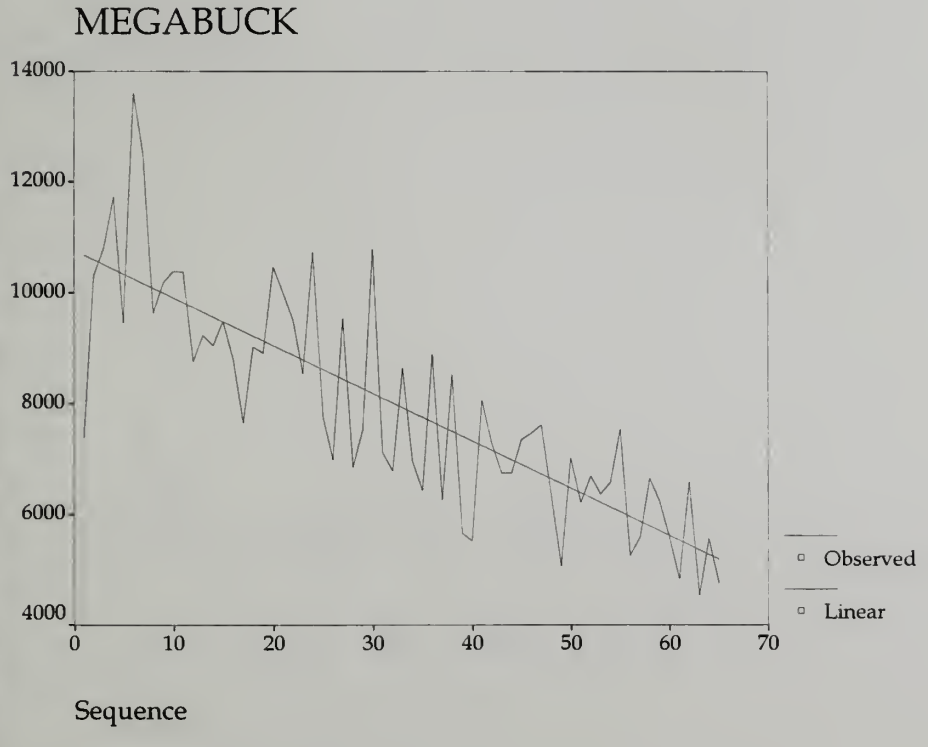
```
Dependent variable.. PULLTABS          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .68285
R Square             .46629
Adjusted R Square    .45782
Standard Error     89.98334

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1        445671.35        445671.35
Residuals      63        510111.05          8097.00

F =      55.04153       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta         T  Sig T

Time                -4.413462     .594886   -.682854    -7.419  .0000
(Constant)         516.444231   22.582191               22.870  .0000

The following new variables are being created:

  Name        Label

  FIT_5       Fit for PULLTABS from CURVEFIT, MOD_5 LINEAR
  ERR_5       Error for PULLTABS from CURVEFIT, MOD_5 LINEAR
```



Curve Fit

```
MODEL:  MOD_6.
```

```
Dependent variable.. MEGABUCK          Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .81540
R Square             .66488
Adjusted R Square    .65956
Standard Error   1160.65858

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1      168383533.4      168383533.4
Residuals      63       84869085.0        1347128.3

F =     124.99443       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                    B        SE B       Beta          T  Sig T

Time              -85.787063    7.673199   -.815404   -11.180  .0000
(Constant)      10759.773077  291.278524                36.940  .0000

The following new variables are being created:

  Name        Label

  FIT_6       Fit for MEGABUCK from CURVEFIT, MOD_6 LINEAR
  ERR_6       Error for MEGABUCK from CURVEFIT, MOD_6 LINEAR
```



Curve Fit

```
MODEL:  MOD_7.
```

Dependent variable.. MASSMILL Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R	.27104
R Square	.07346
Adjusted R Square	.05876
Standard Error	5999.46728

Analysis of Variance:

	DF	Sum of Squares	Mean Square
Regression	1	179796207.0	179796207.0
Residuals	63	2267597278.0	35993607.6

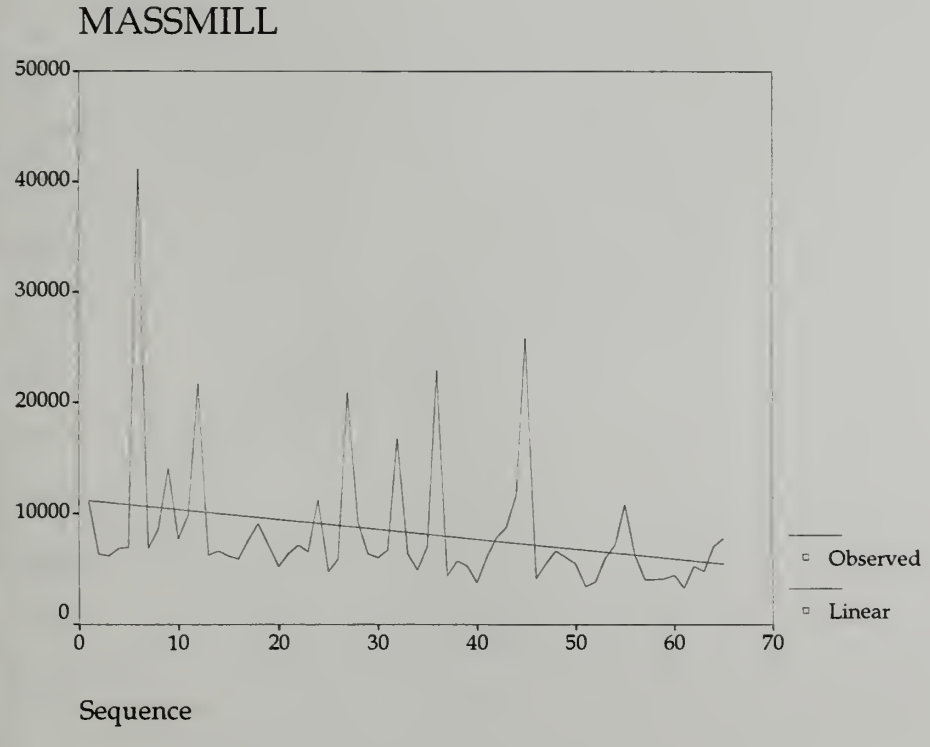
F = 4.99523 Signif F = .0290

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
Time	-88.646635	39.662920	-.271043	-2.235	.0290
(Constant)	11226.123558	1505.624486		7.456	.0000

The following new variables are being created:

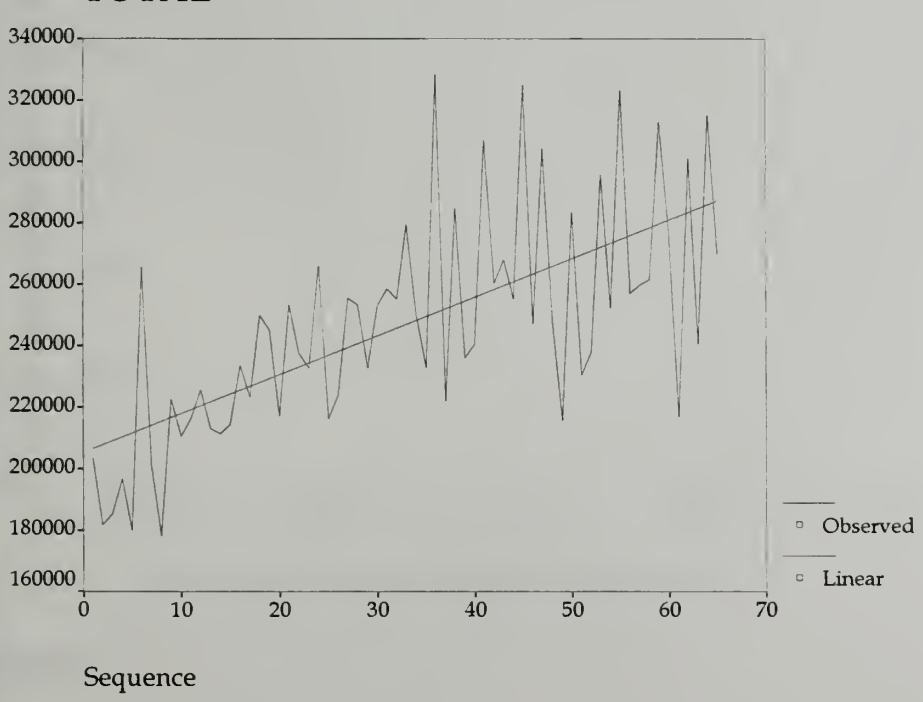
Name	Label
FIT_7	Fit for MASSMILL from CURVEFIT, MOD_7 LINEAR
ERR_7	Error for MASSMILL from CURVEFIT, MOD_7 LINEAR



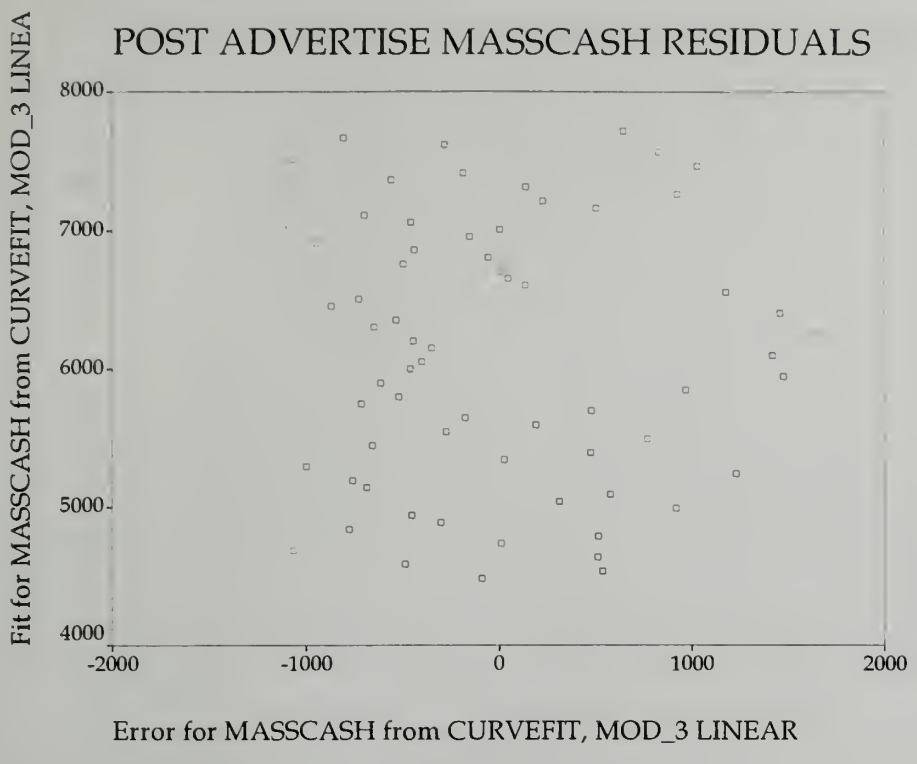
Curve Fit

MODEL: MOD_8.

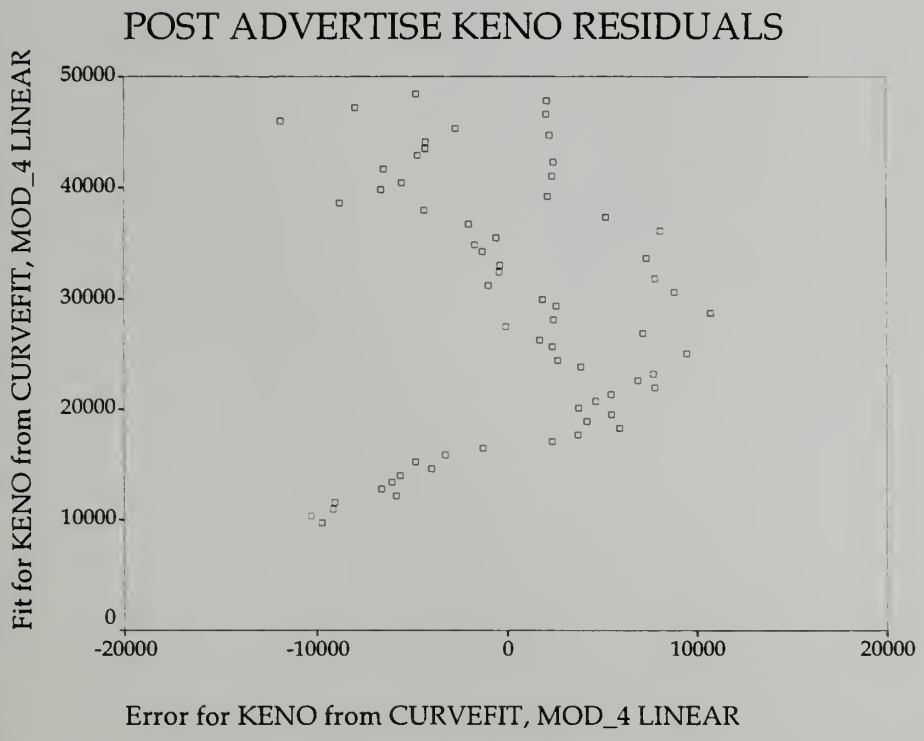
```
Dependent variable.. TOTAL            Method.. LINEAR

Listwise Deletion of Missing Data

Multiple R           .65621
R Square             .43061
Adjusted R Square    .42158
Standard Error  27698.21734

           Analysis of Variance:

               DF   Sum of Squares      Mean Square

Regression      1    36553130655.7    36553130655.7
Residuals      63    48333048374.9      767191244.0

F =      47.64540       Signif F =  .0000

-------------------- Variables in the Equation --------------------

Variable                   B        SE B       Beta         T  Sig T

Time            1263.962762  183.114953    .656211     6.903  .0000
(Constant)    205195.305769 6951.136216               29.520  .0000

The following new variables are being created:

  Name        Label

  FIT_8       Fit for TOTAL from CURVEFIT, MOD_8 LINEAR
  ERR_8       Error for TOTAL from CURVEFIT, MOD_8 LINEAR
```



Graph

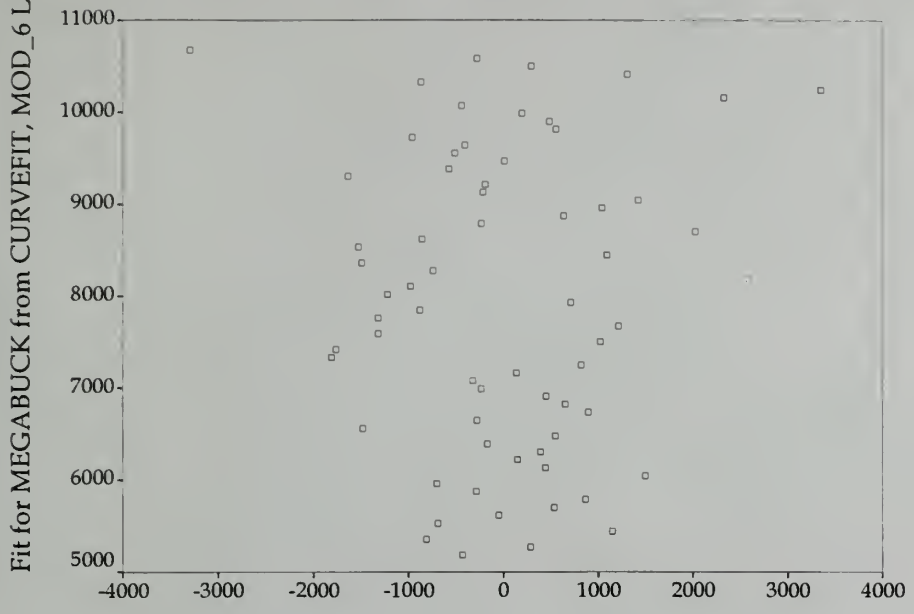

POST ADVERTISE MASSCASH RESIDUALS
Fit for MASSCASH from CURVEFIT, MOD_3 LINEA
8000
7000
6000
5000
4000
-2000
-1000
0
1000
2000
Error for MASSCASH from CURVEFIT, MOD_3 LINEAR

Graph


POST ADVERTISE KENO RESIDUALS
Fit for KENO from CURVEFIT, MOD_4 LINEAR
50000
40000
30000
20000
10000
0
-20000
-10000
0
10000
20000
Error for KENO from CURVEFIT, MOD_4 LINEAR

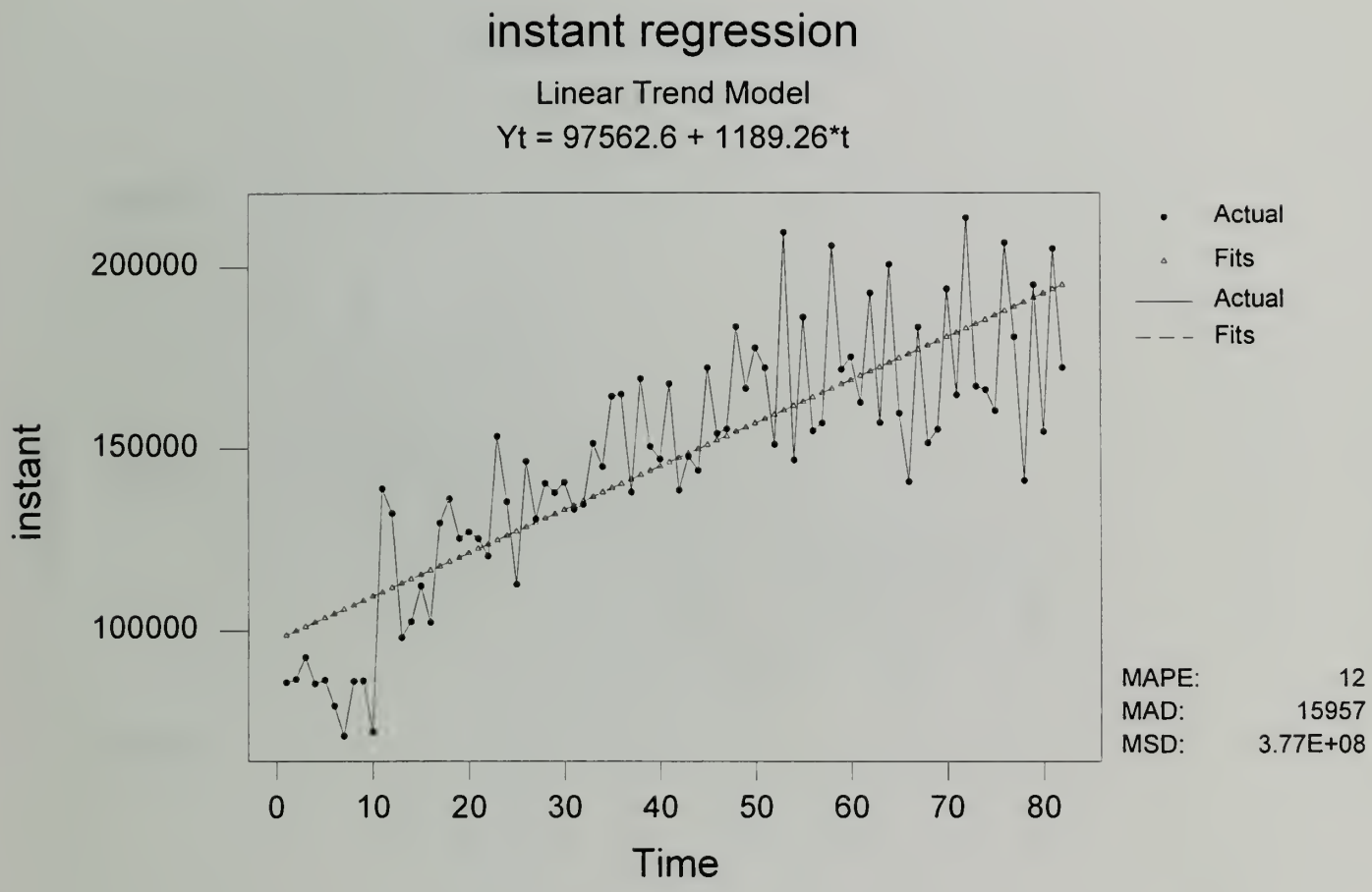
Graph

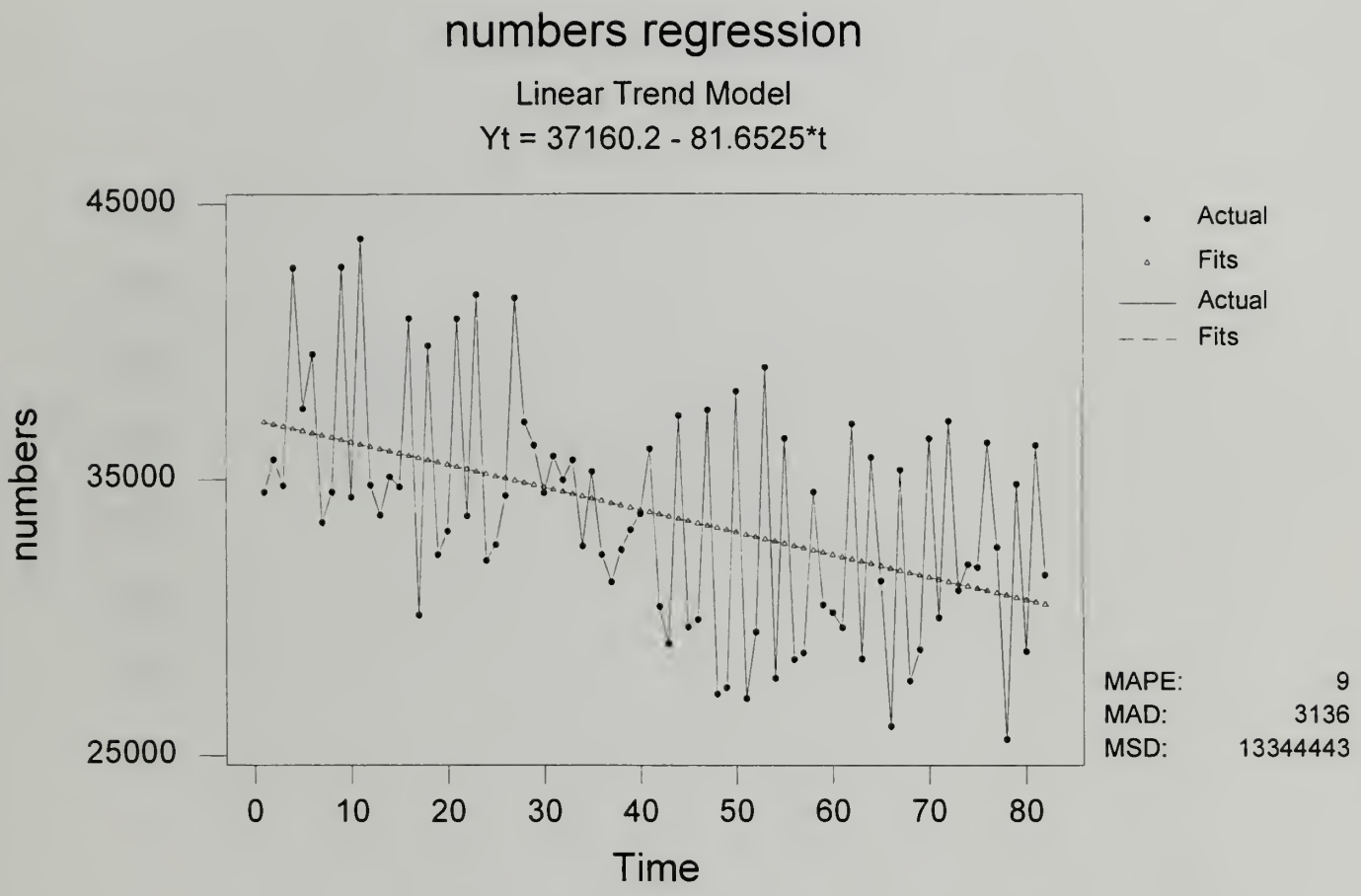
POST ADVERTISE MEGABUCKS RESIDUALS

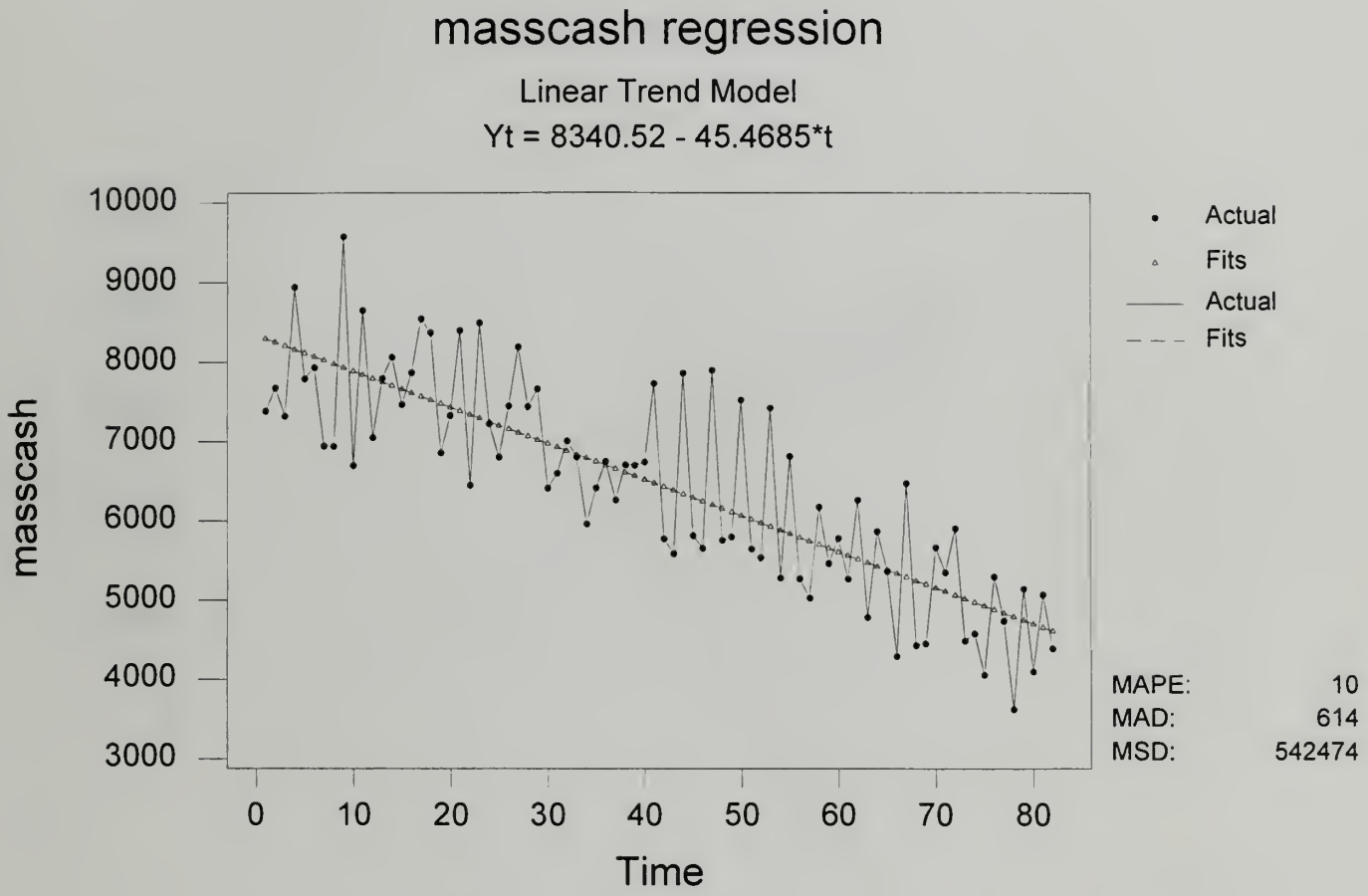


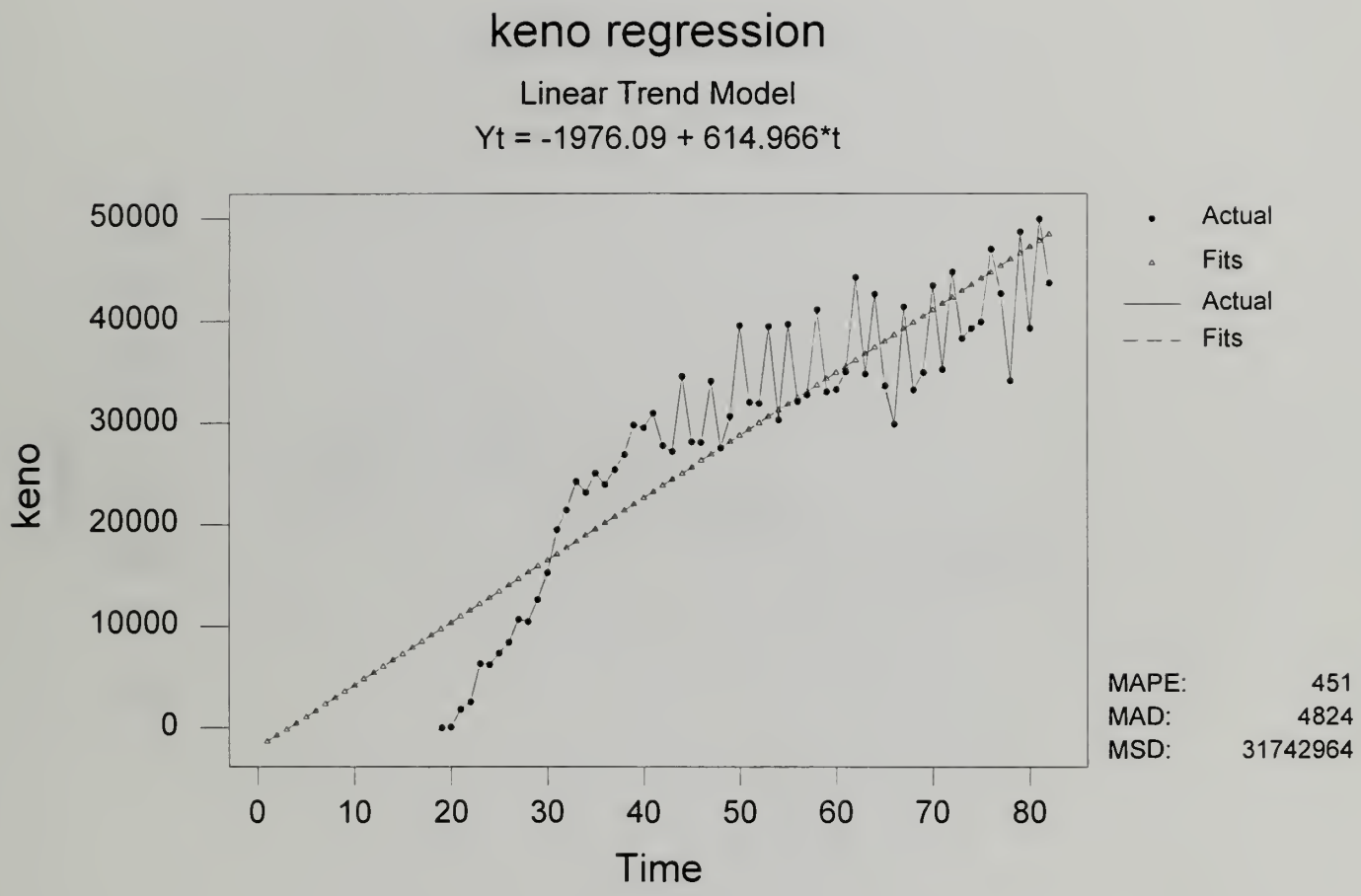
APPENDIX G

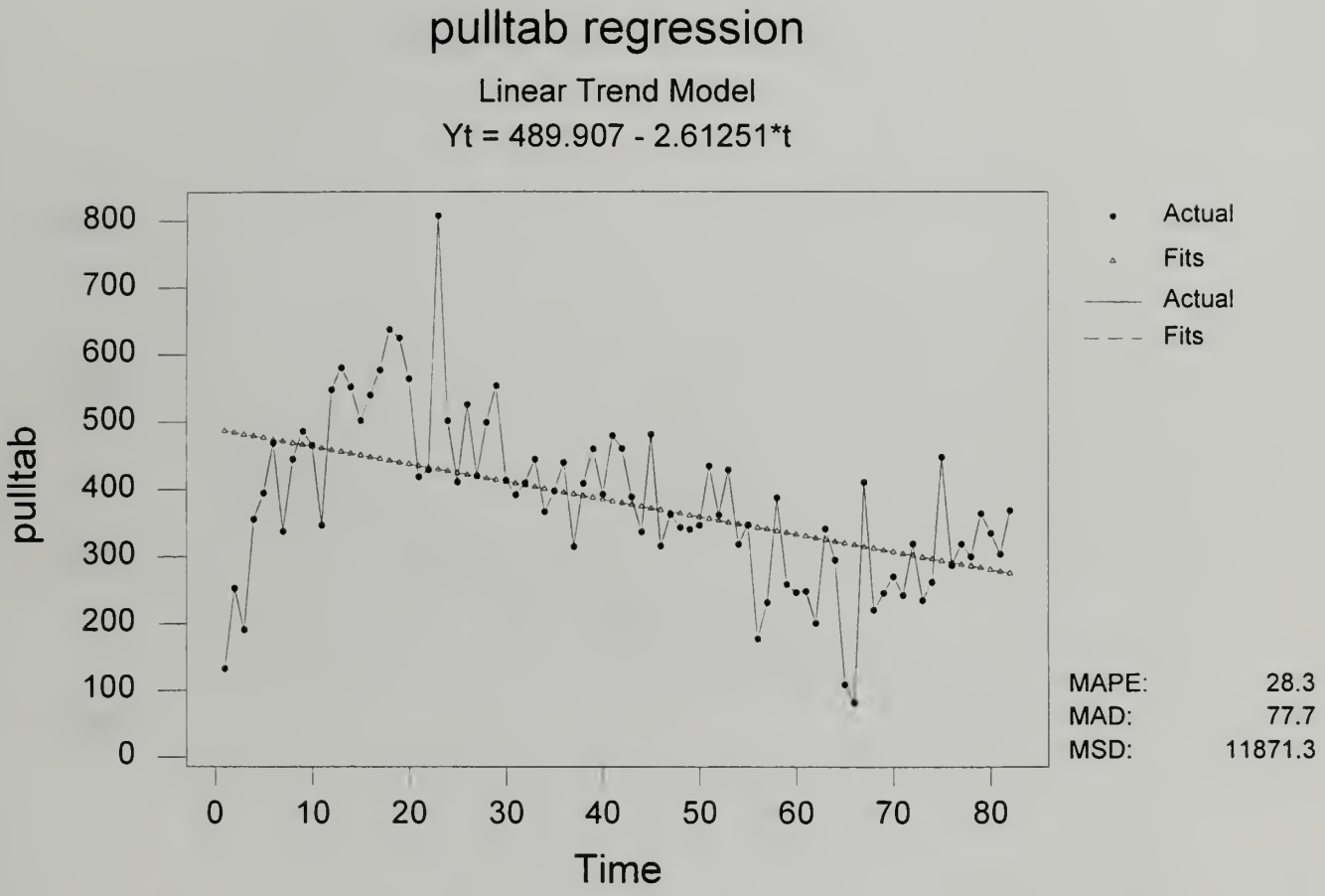
LINEAR TREND MODELS FOR MSL POST PLUS $1 INSTANT TICKETS

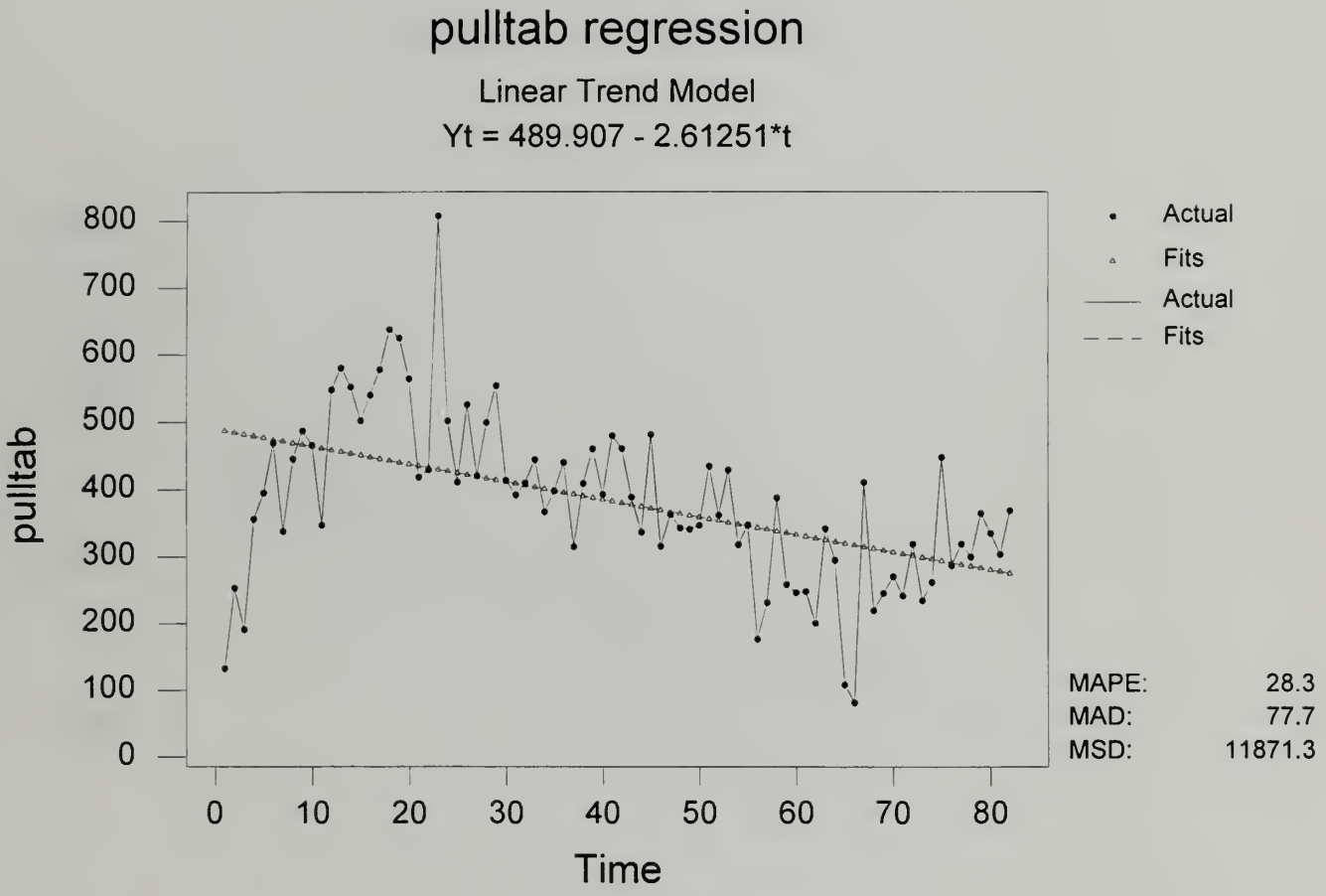

instant regression
Linear Trend Model
Yt = 97562.6 + 1189.26*t
instant
200000
150000
100000
0
10
20
30
40
50
60
70
80
Time
Actual
Fits
Actual
Fits
MAPE: 12
MAD: 15957
MSD: 3.77E+08

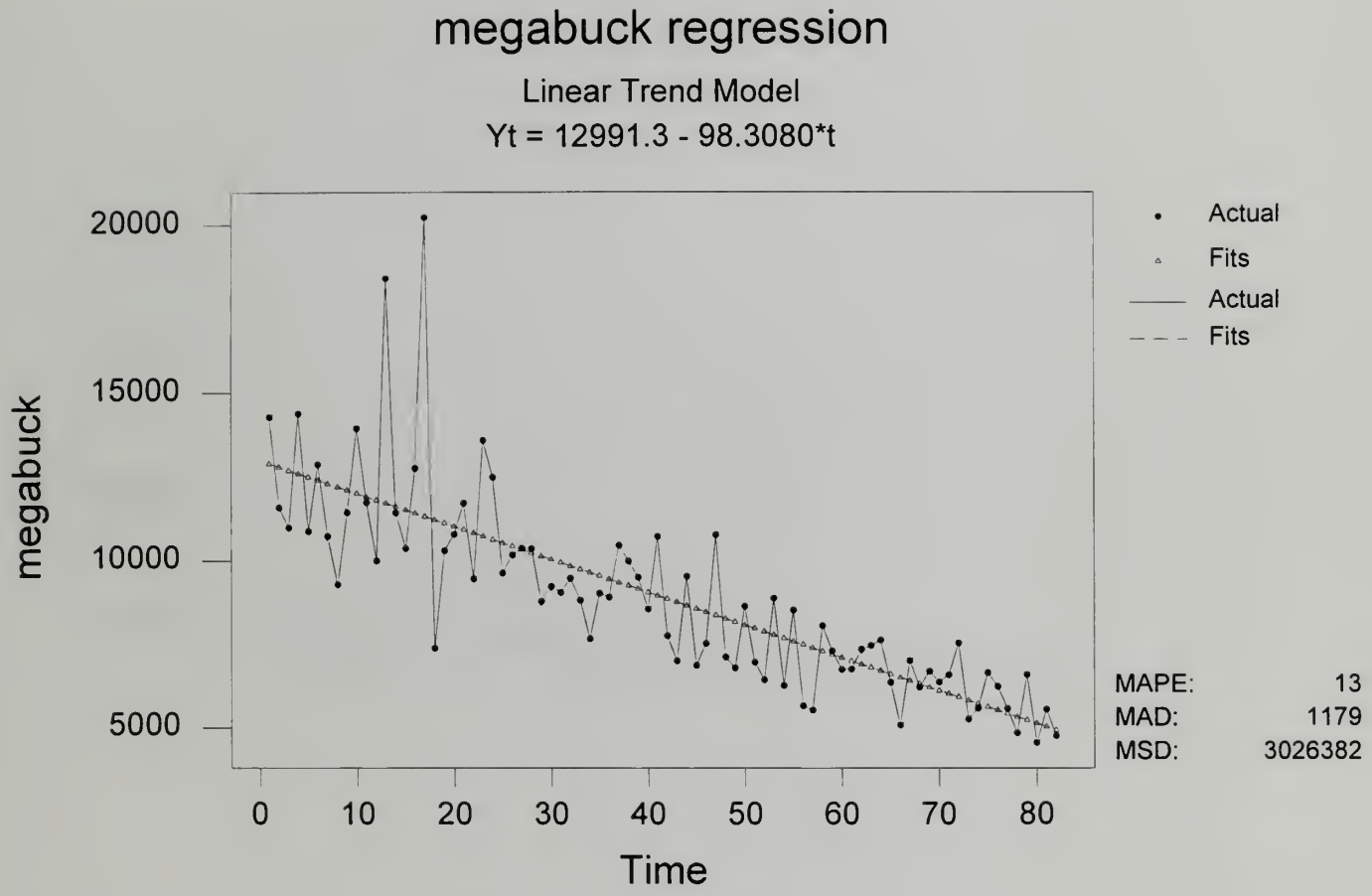

numbers regression
Linear Trend Model
Yt = 37160.2 - 81.6525*t
45000
35000
25000
numbers
0
10
20
30
40
50
60
70
80
Time
Actual
Fits
Actual
Fits
MAPE: 9
MAD: 3136
MSD: 13344443

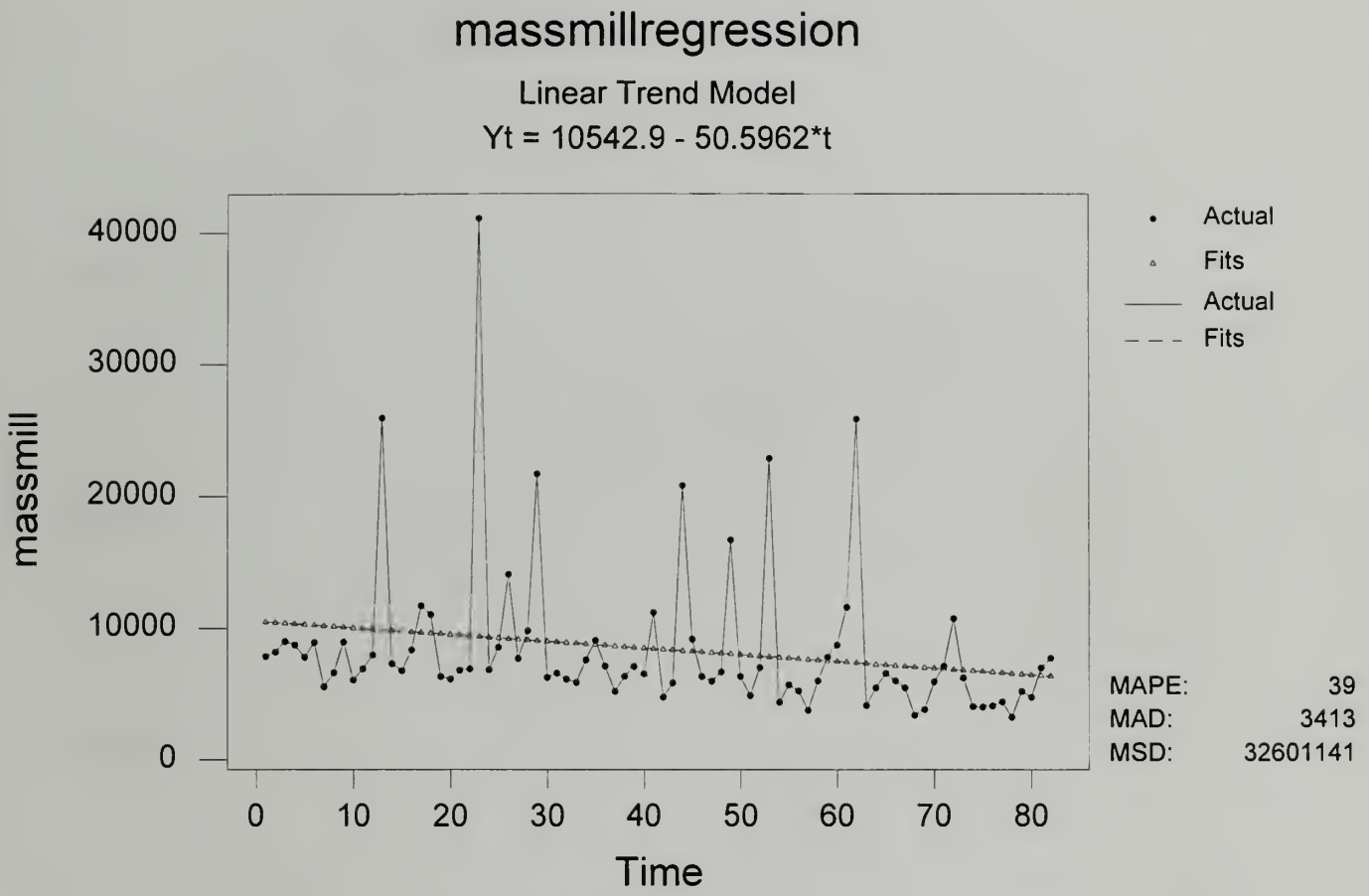

masscash regression
Linear Trend Model
Yt = 8340.52 - 45.4685*t
masscash
10000
9000
8000
7000
6000
5000
4000
3000
0
10
20
30
40
50
60
70
80
Time
Actual
Fits
Actual
Fits
MAPE: 10
MAD: 614
MSD: 542474

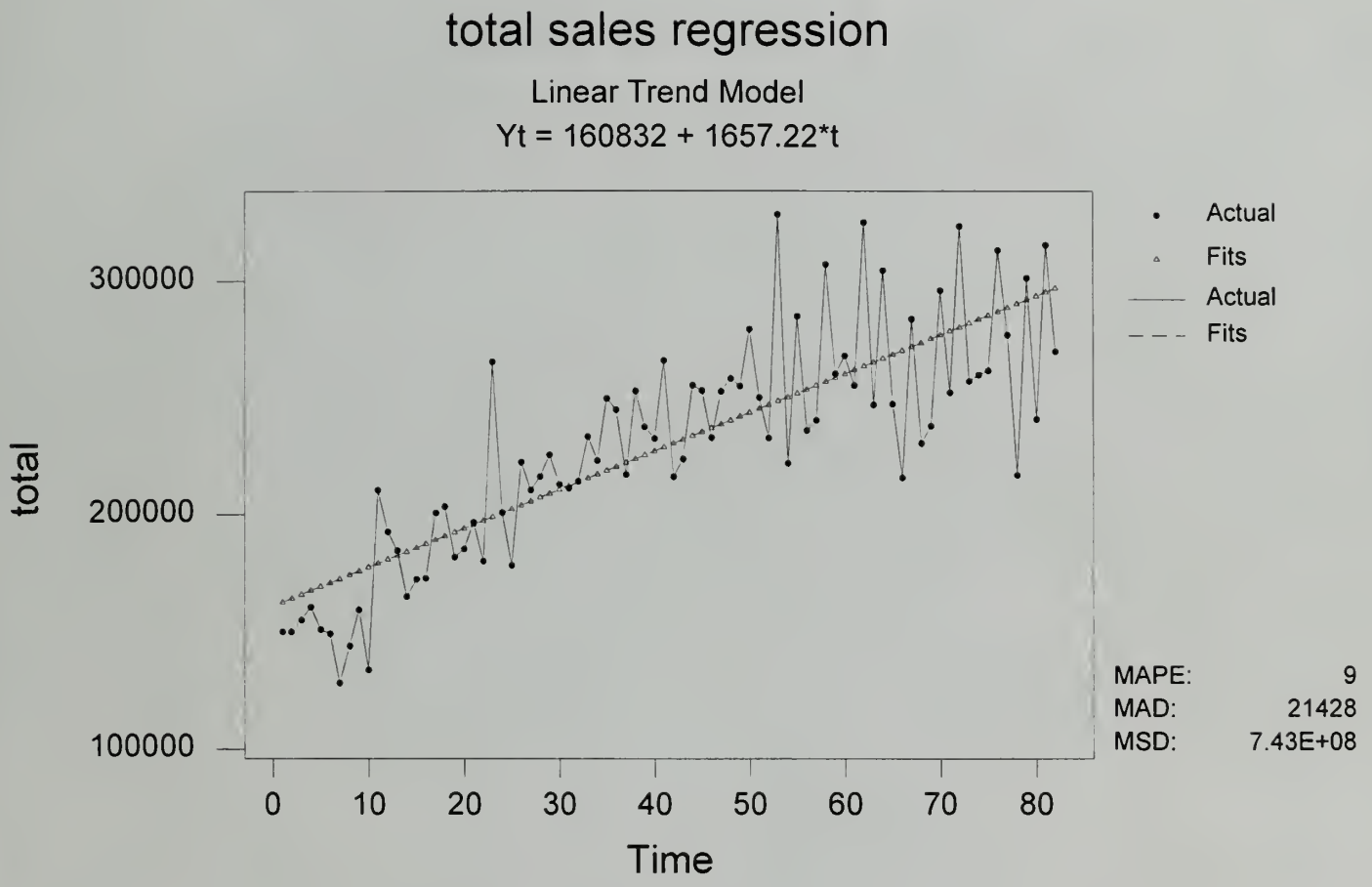

keno regression
Linear Trend Model
Yt = -1976.09 + 614.966*t
keno
50000
40000
30000
20000
10000
0
0
10
20
30
40
50
60
70
80
Time
Actual
Fits
Actual
Fits
MAPE: 451
MAD: 4824
MSD: 31742964


pulltab regression
Linear Trend Model
Yt = 489.907 - 2.61251*t
pulltab
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
Time
Actual
Fits
Actual
Fits
MAPE: 28.3
MAD: 77.7
MSD: 11871.3


pulltab regression
Linear Trend Model
Yt = 489.907 - 2.61251*t
pulltab
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
Time
Actual
Fits
Actual
Fits
MAPE: 28.3
MAD: 77.7
MSD: 11871.3

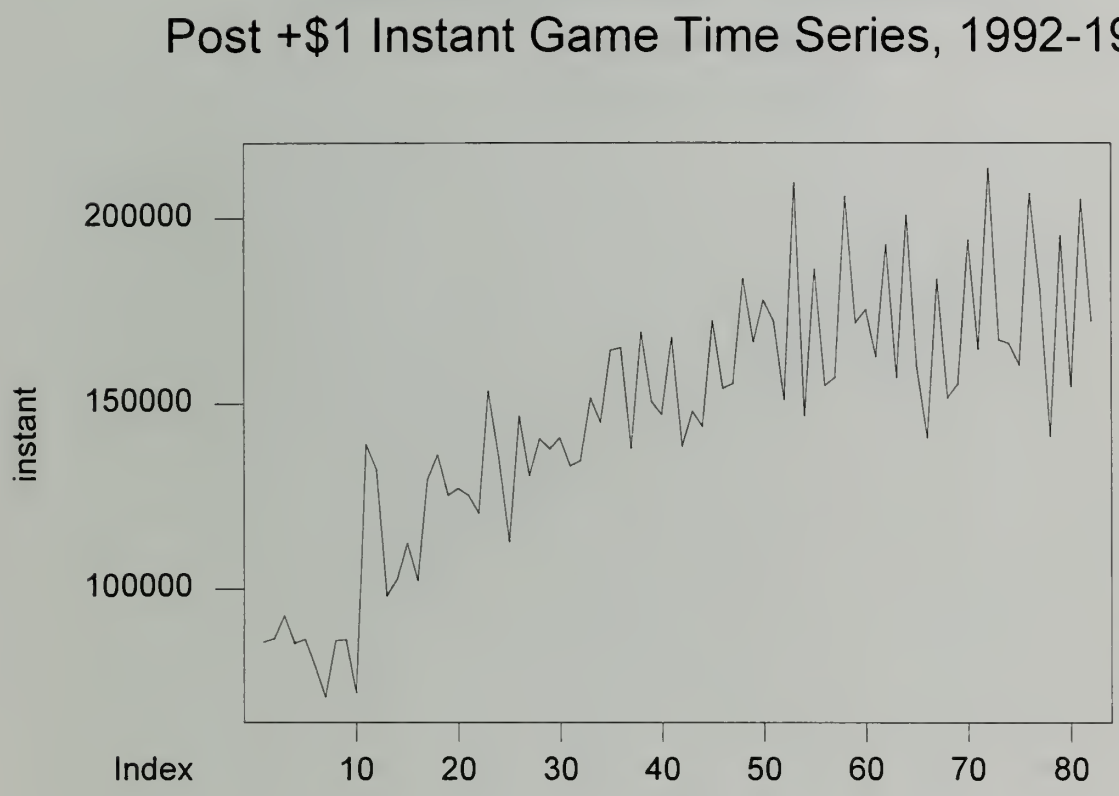

megabuck regression
Linear Trend Model
Yt = 12991.3 - 98.3080*t
megabuck
20000
15000
10000
5000
0
10
20
30
40
50
60
70
80
Time
Actual
Fits
Actual
Fits
MAPE: 13
MAD: 1179
MSD: 3026382

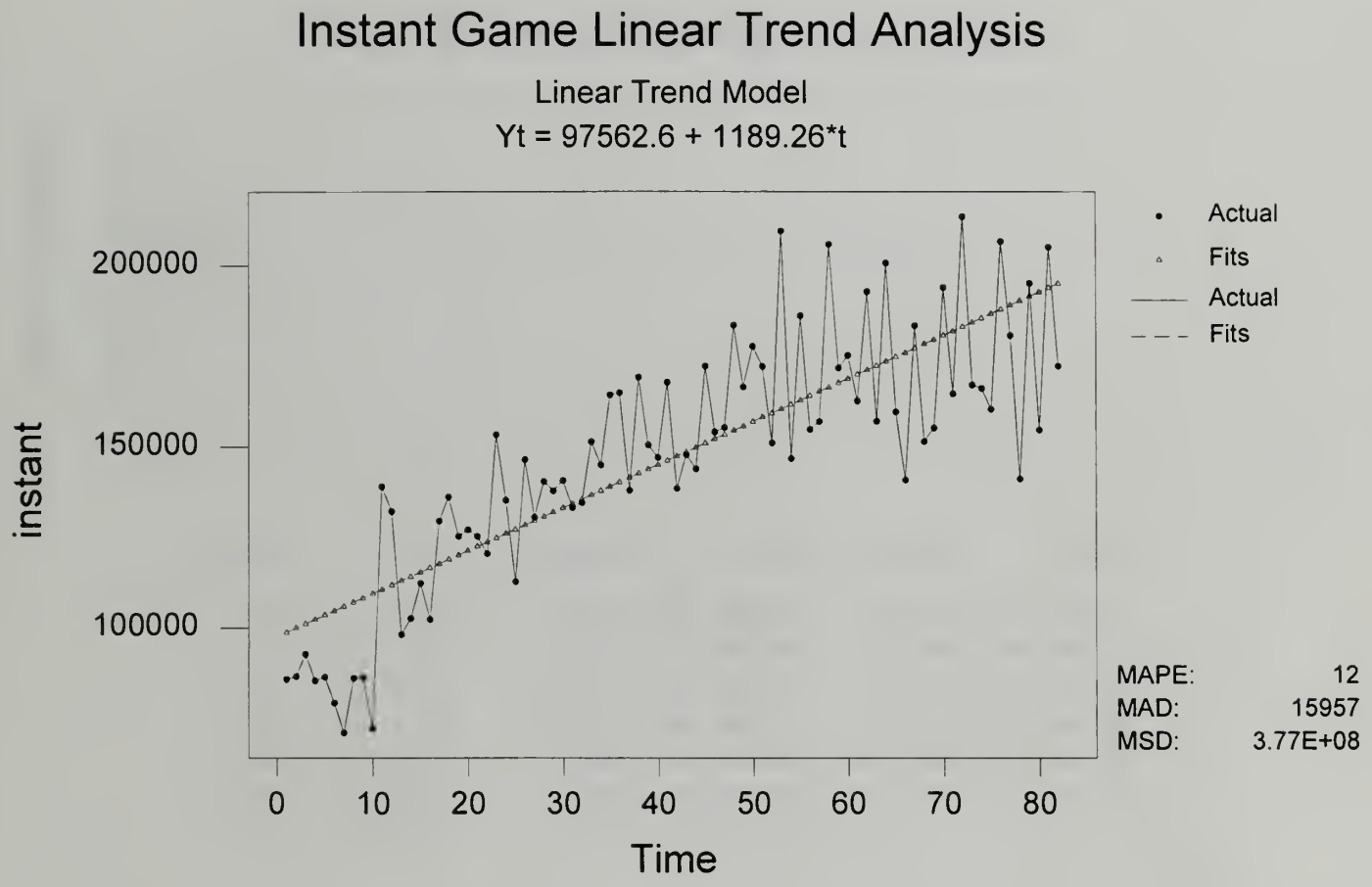

massmillregression
Linear Trend Model
Yt = 10542.9 - 50.5962*t
massmill
40000
30000
20000
10000
0
0
10
20
30
40
50
60
70
80
Time
Actual
Fits
Actual
Fits
MAPE: 39
MAD: 3413
MSD: 32601141


total sales regression
Linear Trend Model
Yt = 160832 + 1657.22*t
total
300000
200000
100000
0
10
20
30
40
50
60
70
80
Time
Actual
Fits
Actual
Fits
MAPE: 9
MAD: 21428
MSD: 7.43E+08

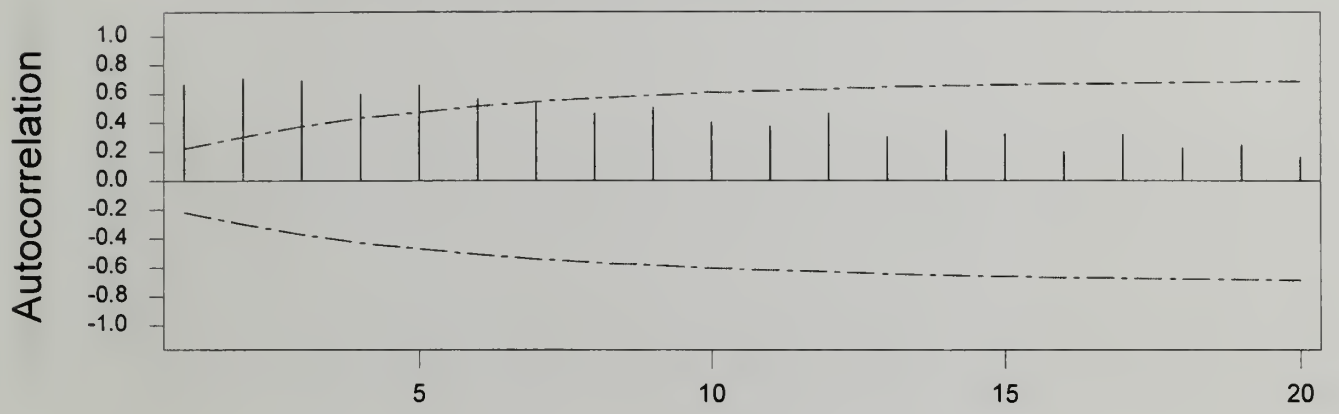
APPENDIX H

ARIMA MATERIALS FOR POST PLUS $1 INSTANT TICKETS


Post +$1 Instant Game Time Series, 1992-1998
instant
200000
150000
100000
Index
10
20
30
40
50
60
70
80

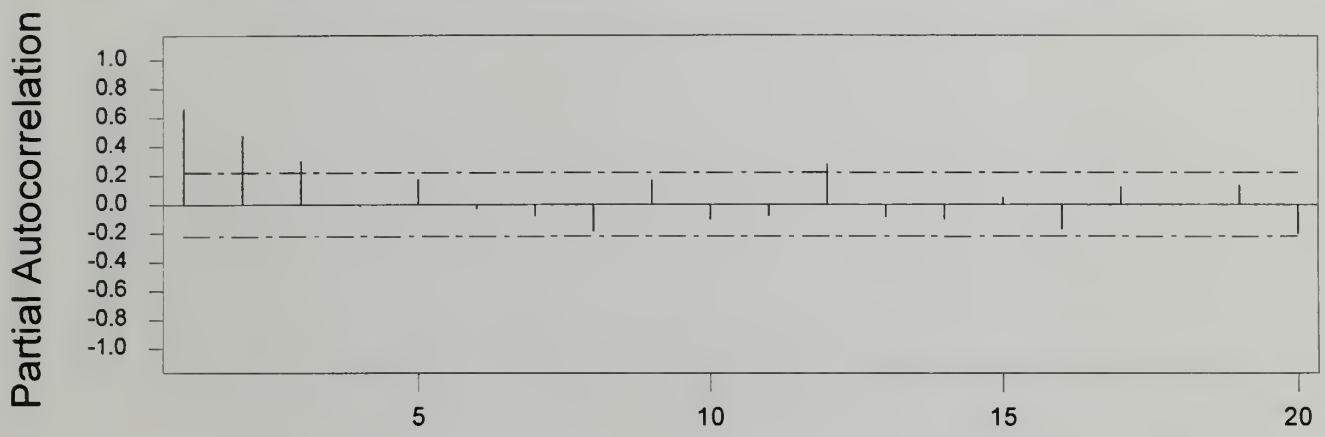

Instant Game Linear Trend Analysis
Linear Trend Model
Yt = 97562.6 + 1189.26*t
instant
200000
150000
100000
0
10
20
30
40
50
60
70
80
Time
Actual
Fits
Actual
Fits
MAPE: 12
MAD: 15957
MSD: 3.77E+08

Post +$1 Instant Game Time Series



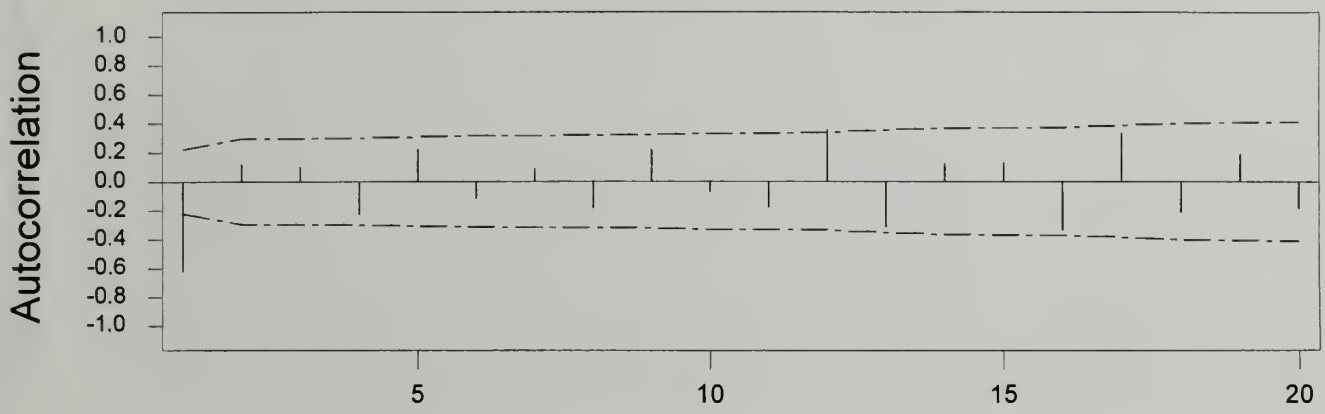
Lag	Corr	T	LBQ	Lag	Corr	T	LBQ	Lag	Corr	T	LBQ
1	0.67	6.02	37.62	8	0.46	1.62	268.83	15	0.32	0.97	375.50
2	0.71	4.67	80.81	9	0.51	1.72	293.09	16	0.20	0.60	379.71
3	0.69	3.70	122.84	10	0.40	1.33	308.67	17	0.32	0.94	390.44
4	0.60	2.77	154.68	11	0.37	1.20	322.25	18	0.23	0.66	395.89
5	0.66	2.80	193.83	12	0.46	1.47	343.48	19	0.25	0.72	402.54
6	0.57	2.20	222.94	13	0.30	0.93	352.56	20	0.16	0.47	405.45
7	0.53	1.95	248.90	14	0.35	1.06	364.81				

Post +$1 Instant Game Time Series



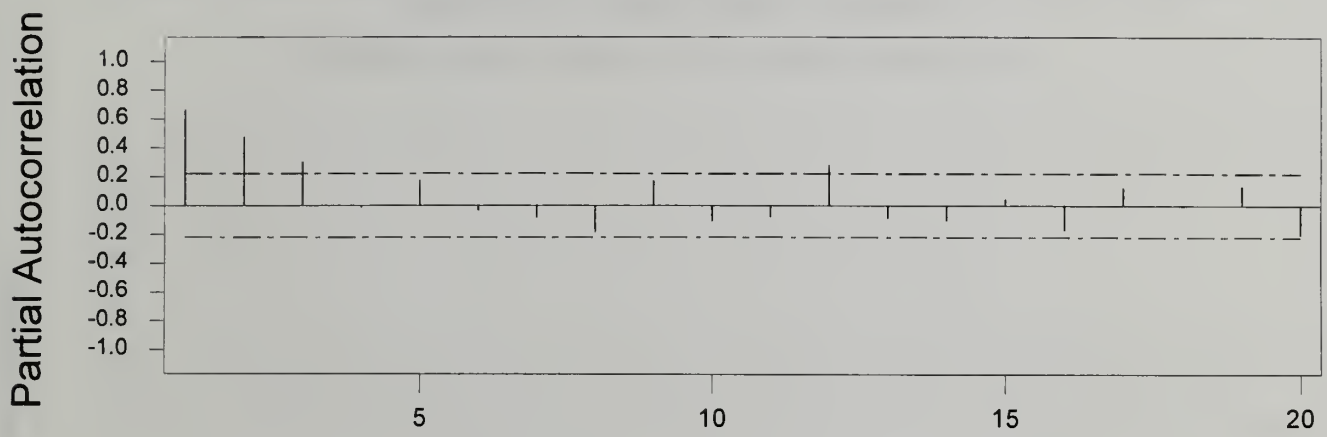
Lag	PAC	T	Lag	PAC	T	Lag	PAC	T
1	0.67	6.02	8	-0.19	-1.69	15	0.05	0.42
2	0.48	4.32	9	0.17	1.54	16	-0.17	-1.55
3	0.30	2.75	10	-0.11	-0.96	17	0.12	1.11
4	-0.01	-0.13	11	-0.08	-0.71	18	-0.01	-0.07
5	0.17	1.57	12	0.28	2.53	19	0.13	1.20
6	-0.04	-0.32	13	-0.09	-0.81	20	-0.20	-1.83
7	-0.08	-0.75	14	-0.10	-0.94			

ACF Post +$1 Instant Differenced Game Time Series

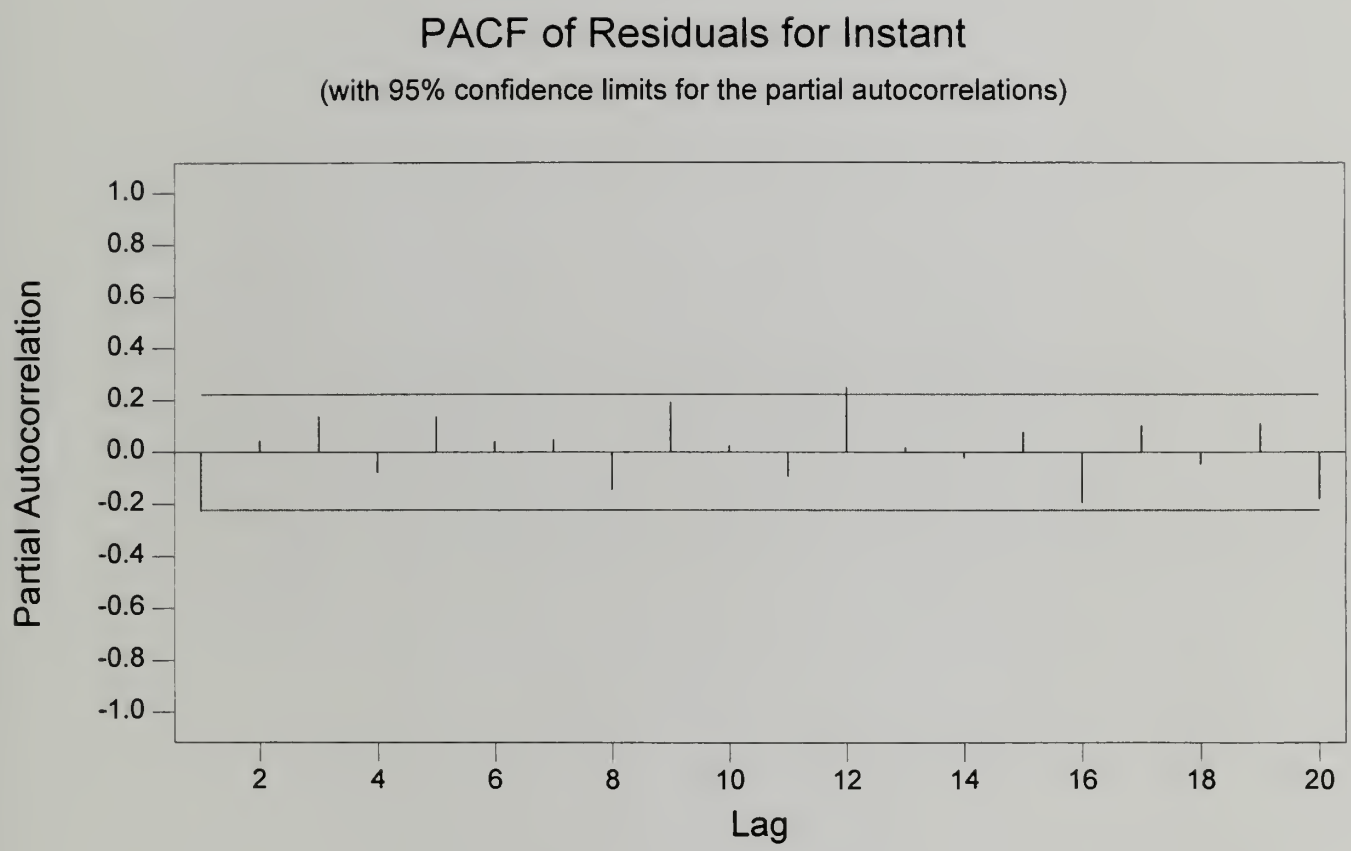


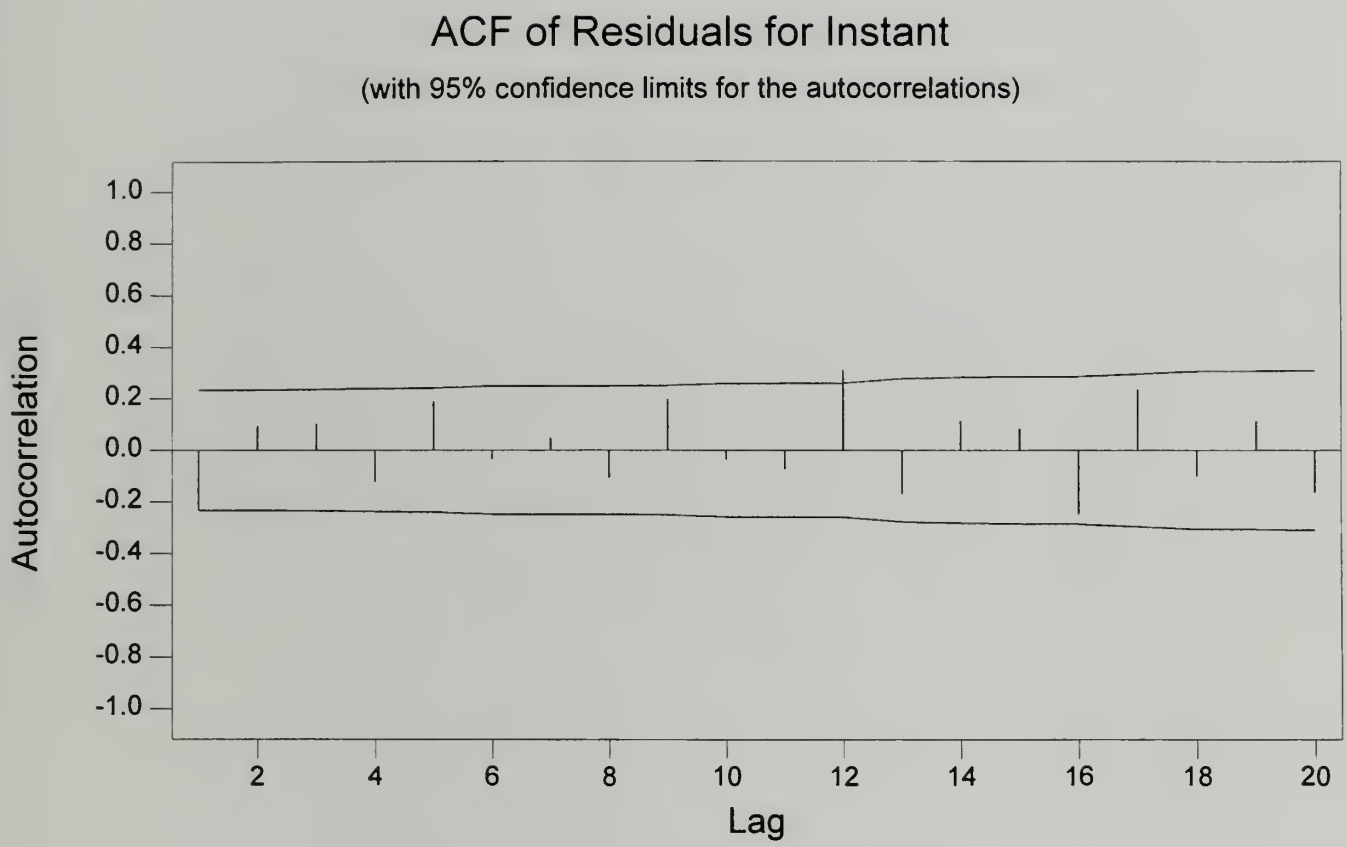
Lag	Corr	T	LBQ	Lag	Corr	T	LBQ	Lag	Corr	T	LBQ
1	-0.62	-5.60	32.51	8	-0.19	-1.16	48.57	15	0.13	0.70	82.24
2	0.12	0.80	33.70	9	0.22	1.36	53.10	16	-0.34	-1.81	94.06
3	0.10	0.68	34.58	10	-0.07	-0.43	53.57	17	0.34	1.73	105.92
4	-0.23	-1.50	39.03	11	-0.18	-1.08	56.68	18	-0.21	-1.07	110.82
5	0.22	1.45	43.47	12	0.36	2.12	69.13	19	0.19	0.93	114.75
6	-0.12	-0.74	44.71	13	-0.32	-1.77	78.97	20	-0.18	-0.89	118.45
7	0.09	0.55	45.41	14	0.13	0.68	80.54				

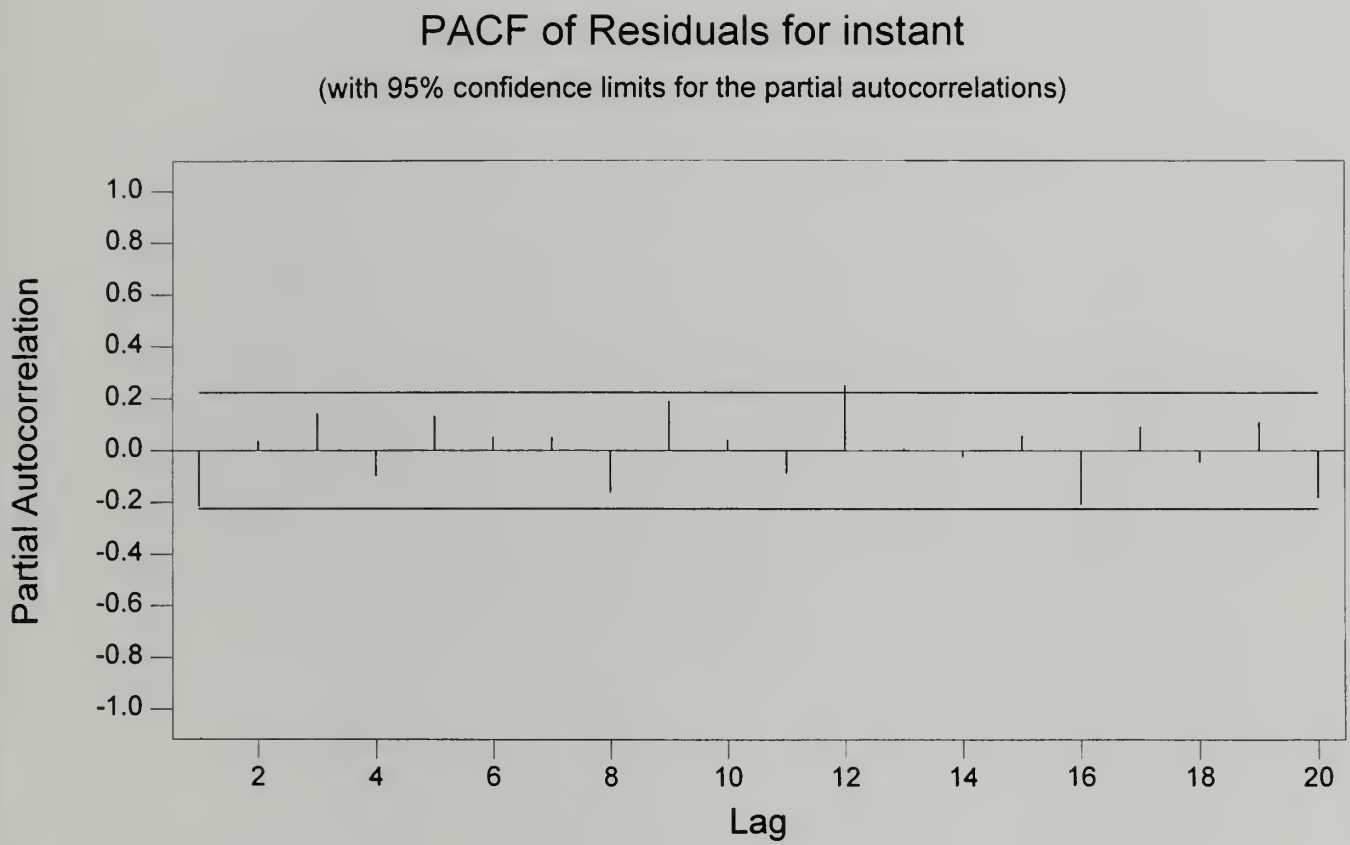
PACF Post +$1 Instant Differenced Game Time Series

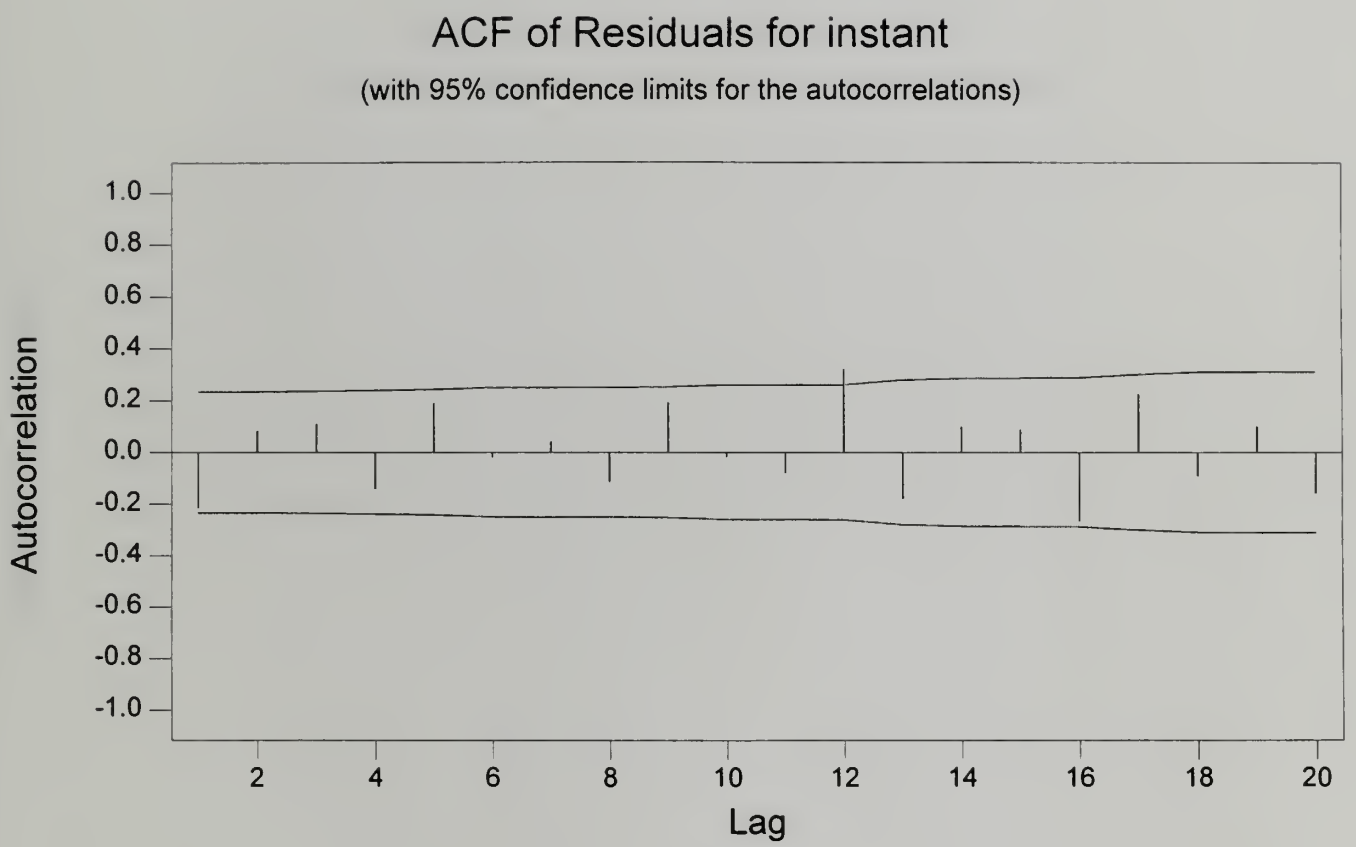


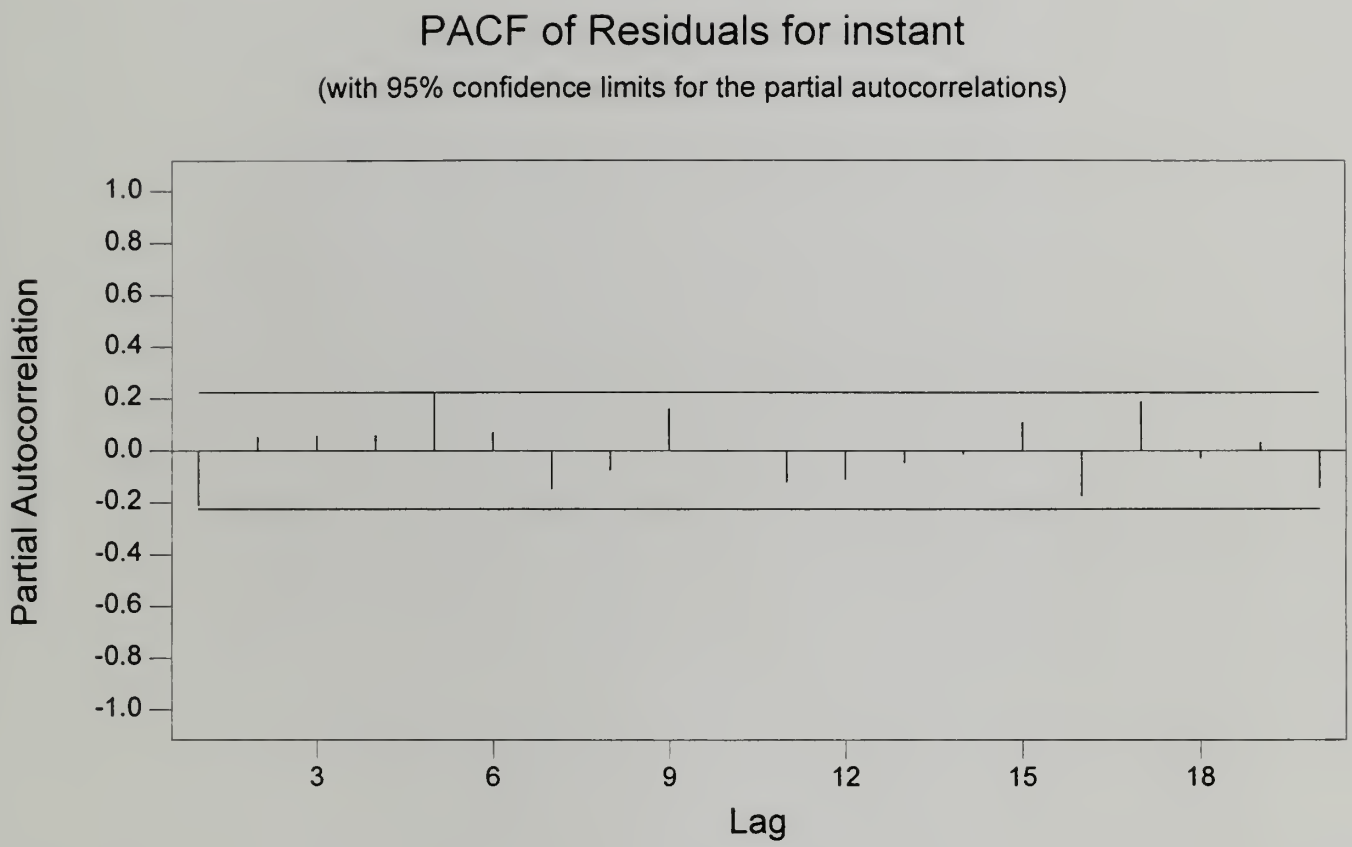
Lag	PAC	T	Lag	PAC	T	Lag	PAC	T
1	0.67	6.02	8	-0.19	-1.69	15	0.05	0.42
2	0.48	4.32	9	0.17	1.54	16	-0.17	-1.55
3	0.30	2.75	10	-0.11	-0.96	17	0.12	1.11
4	-0.01	-0.13	11	-0.08	-0.71	18	-0.01	-0.07
5	0.17	1.57	12	0.28	2.53	19	0.13	1.20
6	-0.04	-0.32	13	-0.09	-0.81	20	-0.20	-1.83
7	-0.08	-0.75	14	-0.10	-0.94			

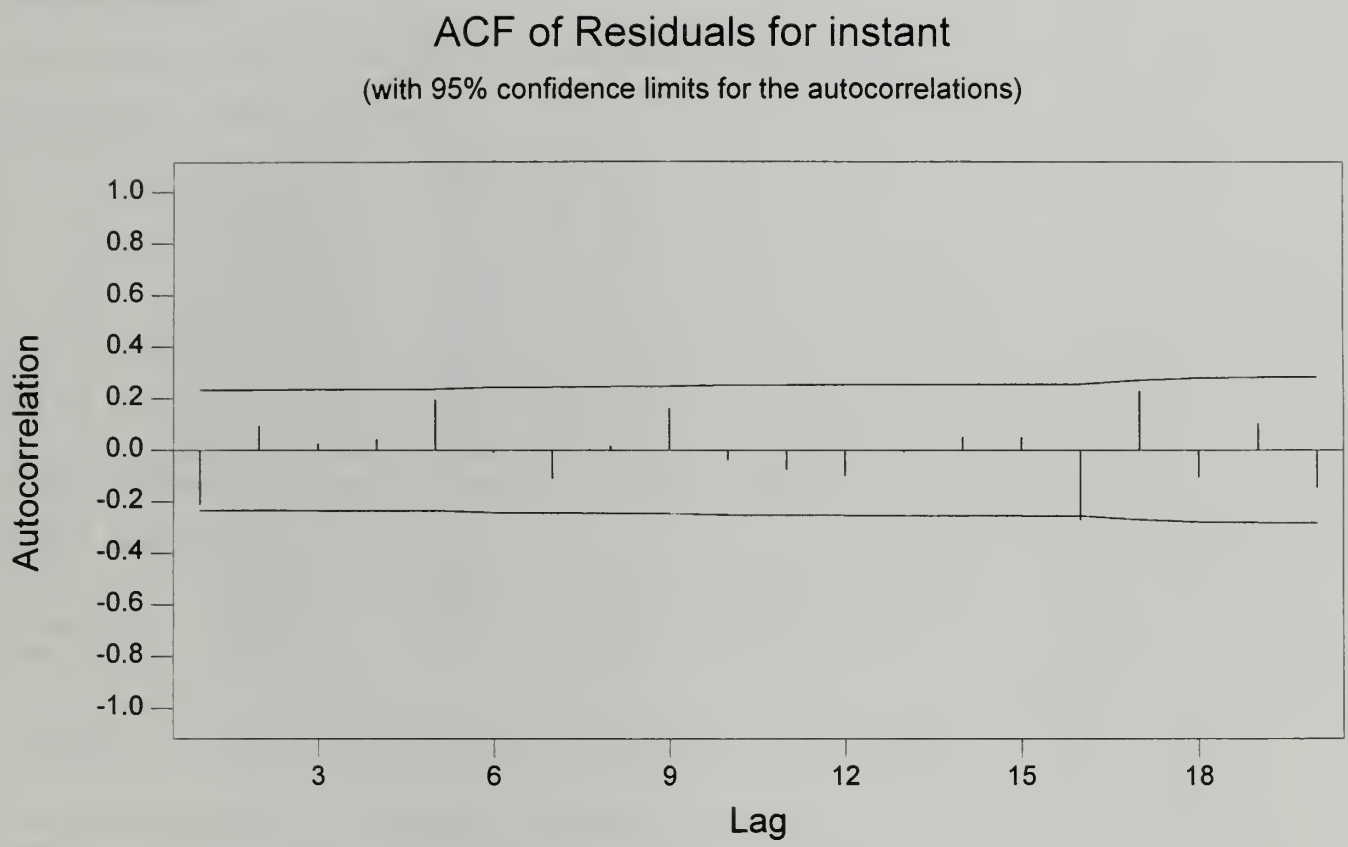

PACF of Residuals for Instant
(with 95% confidence limits for the partial autocorrelations)
Partial Autocorrelation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
2
4
6
8
10
12
14
16
18
20
Lag


ACF of Residuals for Instant
(with 95% confidence limits for the autocorrelations)
Autocorrelation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
2
4
6
8
10
12
14
16
18
20
Lag


PACF of Residuals for instant
(with 95% confidence limits for the partial autocorrelations)
Partial Autocorrelation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
2
4
6
8
10
12
14
16
18
20
Lag


ACF of Residuals for instant
(with 95% confidence limits for the autocorrelations)
Autocorrelation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
2
4
6
8
10
12
14
16
18
20
Lag


PACF of Residuals for instant
(with 95% confidence limits for the partial autocorrelations)
Partial Autocorrelation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
3
6
9
12
15
18
Lag


ACF of Residuals for instant
(with 95% confidence limits for the autocorrelations)
Autocorrelation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
3
6
9
12
15
18
Lag

Trend Analysis

Fitted Trend Equation for Post +$1 Instant Game Time Series

Yt = 97562.6 + 1189.26*t

Accuracy Measures

MAPE:	11.6634
MAD:	15957.0
MSD:	377470529

ARIMA Model

ARIMA model for post +$1 Instant Differenced Time Series

Estimates at each iteration

Iteration	SSE	Parameters
0	53004136739	0.100 1069.915
1	44945188042	0.250 1130.338
2	38743789759	0.400 1162.114
3	33918862955	0.550 1174.392
4	30229543827	0.700 1180.355
5	28130326342	0.850 1204.908
6	28121336274	0.863 1214.240
7	28118623009	0.858 1204.129
8	28118435485	0.860 1208.122
9	28118368211	0.859 1206.709
10	28118367351	0.859 1206.982

Relative change in each estimate less than 0.0010

Final Estimates of Parameters

Type		Coef	StDev	T	P
MA	1	0.8591	0.0582	14.76	0.000
Constant		1207.0	312.7	3.86	0.000
Mean		1207.0	312.7		

Number of observations: 81
Residuals: SS = 28118326535 (backforecasts excluded)
MS = 355928184 DF = 79

Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag	12	24	36	48
Chi-Square	25.5	49.9	57.7	71.0
DF	10	22	34	46
P-Value	0.005	0.001	0.007	0.010

ARIMA Model

ARIMA model for Instant Diff

Estimates at each iteration

Iteration	SSE	Parameters		
0	57170225928	0.100	0.100	1069.915
1	45523730498	0.250	0.019	1097.553
2	37469864041	0.400	-0.053	1122.779
3	31652394246	0.550	-0.120	1142.919
4	27368333739	0.700	-0.193	1164.529
5	24535792189	0.850	-0.296	1212.114

```
    6     23479063336    0.875   -0.446 1245.922
    7     22794170502    0.877   -0.567 1261.346
    8     22219796086    0.880   -0.672 1280.984
    9     21879715070    0.883   -0.750 1289.609
   10     21842785769    0.885   -0.770 1284.853
   11     21841099303    0.886   -0.774 1281.523
   12     21841032114    0.886   -0.775 1280.516
   13     21841032100    0.886   -0.775 1280.500
Relative change in each estimate less than  0.0010

Final Estimates of Parameters
Type          Coef       StDev         T        P
MA   1      0.8861      0.0508     17.45    0.000
SMA 12     -0.7752      0.1094     -7.09    0.000
Constant    1280.5       363.2      3.53    0.001
Mean        1280.5       363.2

Number of observations:  81
Residuals:    SS =   19463583000  (backforecasts excluded)
              MS =    249533115  DF = 78

Modified Box-Pierce (Ljung-Box) Chi-Square statistic
Lag               12         24         36         48
Chi-Square      13.5       33.9       44.3       60.1
DF                 9         21         33         45
P-Value        0.140      0.037      0.090      0.066
```

ARIMA Model

```
ARIMA model for (0,0,1)(0,0,1) Post +$1 instant lagged differenced time series

Estimates at each iteration
Iteration        SSE     Parameters
    0     52138131447    0.100 1491.988
    1     44386422102    0.250 1391.127
    2     38392355569    0.400 1312.960
    3     33698944581    0.550 1252.428
    4     30075817333    0.700 1216.092
    5     27961168019    0.850 1224.135
    6     27945595777    0.867 1243.089
    7     27941272417    0.861 1230.662
    8     27941101424    0.862 1234.998
    9     27941040827    0.862 1233.777
Relative change in each estimate less than  0.0010

Final Estimates of Parameters
Type          Coef       StDev         T        P
MA   1      0.8618      0.0575     14.98    0.000
Constant    1233.8       309.7      3.98    0.000
Mean        1233.8       309.7

Number of observations:  80
Residuals:    SS =   27941017085  (backforecasts excluded)
              MS =    358218168  DF = 78

Modified Box-Pierce (Ljung-Box) Chi-Square statistic
Lag               12         24         36         48
Chi-Square      25.6       50.2       58.6       73.3
DF                10         22         34         46
P-Value        0.004      0.001      0.005      0.006
```

Forecasts from period 82

Period	Forecast	95 Percent Limits Lower	Upper	Actual
83	-23340.8	-54450.8	7769.2	
84	-7938.3	-49501.1	33624.6	
85	45042.2	3479.3	86605.0	
86	-28241.1	-69804.0	13321.8	
87	-15379.1	-56942.0	26183.7	
88	15678.5	-25884.4	57241.3	
89	6674.2	-34888.7	48237.0	
90	18219.1	-23343.8	59782.0	
91	-37442.2	-79005.1	4120.6	
92	31266.6	-10296.2	72829.5	
93	-23392.4	-64955.2	18170.5	
94	33363.5	-8199.3	74926.4	
95	-15607.1	-63607.3	32393.1	
96	1308.7	-51194.2	53811.6	
97	1308.7	-51194.2	53811.6	
98	1308.7	-51194.2	53811.6	
99	1308.7	-51194.2	53811.6	
100	1308.7	-51194.2	53811.6	
101	1308.7	-51194.2	53811.6	
102	1308.7	-51194.2	53811.6	
103	1308.7	-51194.2	53811.6	
104	1308.7	-51194.2	53811.6	
105	1308.7	-51194.2	53811.6	
106	1308.7	-51194.2	53811.6	
107	1308.7	-51194.2	53811.6	
108	1308.7	-51194.2	53811.6	
109	1308.7	-51194.2	53811.6	
110	1308.7	-51194.2	53811.6	
111	1308.7	-51194.2	53811.6	
112	1308.7	-51194.2	53811.6	
113	1308.7	-51194.2	53811.6	
114	1308.7	-51194.2	53811.6	
115	1308.7	-51194.2	53811.6	
116	1308.7	-51194.2	53811.6	
117	1308.7	-51194.2	53811.6	
118	1308.7	-51194.2	53811.6	
119	1308.7	-51194.2	53811.6	
120	1308.7	-51194.2	53811.6	
121	1308.7	-51194.2	53811.6	
122	1308.7	-51194.2	53811.6	
123	1308.7	-51194.2	53811.6	
124	1308.7	-51194.2	53811.6	
125	1308.7	-51194.2	53811.6	
126	1308.7	-51194.2	53811.6	
127	1308.7	-51194.2	53811.6	
128	1308.7	-51194.2	53811.6	
129	1308.7	-51194.2	53811.6	
130	1308.7	-51194.2	53811.6	
131	1308.7	-51194.2	53811.6	
132	1308.7	-51194.2	53811.6	
133	1308.7	-51194.2	53811.6	
134	1308.7	-51194.2	53811.6	
135	1308.7	-51194.2	53811.6	
136	1308.7	-51194.2	53811.6	
137	1308.7	-51194.2	53811.6	
138	1308.7	-51194.2	53811.6	
139	1308.7	-51194.2	53811.6	

140	1308.7	-51194.2	53811.6
141	1308.7	-51194.2	53811.6
142	1308.7	-51194.2	53811.6

APPENDIX I

SOURCES FOR STATE GAMING FIGURES

SOURCES

COLORADO

Lottery - FY90-98 Colorado Lottery (website)
http://www.coloradolottery.com/about/financials.html
Gaming - FY 92-98 Division of Gaming and Gaming Commission

CONNECTICUT

Lottery and Gaming - State website
http://www.state.ct.us/dosr/GnrlFundRev.htm

ILLINOIS

Lottery - Illinois Lottery
Gaming - FY 91-97
http://www.revenue.state.il.us/Revpubs/AnnualReport/other15.htm (FY 98 missing)

IOWA

Lottery - FY 89-95 Harrah's - FY 96 *IGWB* April 97 - FY 97 *IGWB* April 98 - FY 98 Iowa Lottery
Gaming - FY 91-95 Harrah's - FY 96-98 Iowa Racing and Gaming Commission (website) http://12.17.193.102/irgc/fy[yr]1.htm

LOUISIANA

Video Poker - FY 98 LA State Police - FY96-97 State Website
http://www.state.la.us/opb/exec-bud99/20-oreq/20-oreq.f.html - FY 93-95 Harrah's study
Lottery - Louisiana Lottery Corporation
Gaming/Riverboat - FY 94-95 Harrah's study - FY 96-98 Louisiana State Police

MASSACHUSETTS

Lottery (Sales) - Massachusetts Lottery Commission except months: 5/94, 7-10/94, 12/94, 2/95, 4/95, 5/95. Months 1/91, 1/93, 2/93, 3/93, 6/93, 6/94 were not specifically furnished but were mathematically figured by following years YTD figures and figures given.

MISSOURI

Lottery - FY 88-98 Missouri Lottery
Gaming - FY 94-95 Harrah's - FY 96-98 Missouri Gaming Commission

NEW JERSEY

Lottery - FY 77-94 Harrah's - FY 95-98 State website
http://www.state.nj.us/lottery
Gaming - FY 78-94 Harrah's - FY 97 State website
http://www.state.nj.us/casinos

SOUTH DAKOTA

Lottery - FY 88-89 Harrah's - 90-98 South Dakota Lottery
Gaming - FY 90-98 South Dakota Commission on Gaming